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REVIEW
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SERIES A.

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VILMORIN-ANDRIEUX - BIBLIOTHÈQUE - VERRIÈRES

HOFFER (A.), KAC (A.) & BLATTNÝ (C.). **První zpráva o bejlomorce plodomorce vojtěškové** (*Contarinia medicaginis*). [First Report on the Lucerne Gall-midge.]—*Ochr. Rost.* **19–20** pp. 35–39. Prague, 1948.

BLATTNÝ (C.), KAC (A.) & HOFFER (A.). **Pozorování a pokusy s pěstováním vojtěšky na semeno, zejména s ohledem na boj proti plodomorce vojteškové a j. škodlivým činitelům vojtěšky.** [Observations on and Experiments with Cultivation of Lucerne for Seed, with particular Reference to the Control of the Lucerne Gall-midge and other noxious Factors affecting Lucerne.]—*T.c.* pp. 40–46, 6 figs. (With a Summary in Russian.)

As *Contarinia medicaginis*, Kieff., had caused very severe damage on lucerne grown for seed in Czechoslovakia in 1938–42, investigations designed to indicate measures of control were made in a district in north-western Bohemia in which lucerne is extensively grown. The first paper deals with the investigations in 1943, when the whole season was unusually dry, and the second with those in 1944, when it was dry from June to the beginning of October. Conditions were thus favourable for the production of lucerne seed and unfavourable for the gall-midge, which was scarce [*cf. R.A.E.*, A **27** 457]. In both years, its development was protracted and only one generation was produced ; parasitism was high, an unidentified Pteromalid parasitising 90 per cent. of the pupae in 1944. The midges were active throughout the day in dull or wet weather, in the late afternoon and evening in warm, sunny weather and only in the early morning on very hot days.

The following are the main conclusions drawn from the investigations. The date of appearance of the midge, the number of generations produced and the intensity of infestation depend on the weather. Emergence from the pupae in the soil is delayed by dry weather, and it is probable that it may be thus delayed from one year to the next, so that low infestation in a dry year will not necessarily result in low infestation in the following season. Seasonal conditions determine whether it is the first or the second mowing of the lucerne that is the more severely attacked and the best way to minimise the risk of loss would be to leave a part of each crop for seed. Lucerne sown on light, dry, sandy soil is not heavily infested, but may not produce a good seed-crop, as the flowers are liable to dry up in dry summers. The heaviest infestation occurs on rich black soil, which is humid and retains moisture, and the lightest on light-coloured loose soil, which forms a crust in dry weather that hinders the emergence of the adults. Differences in intensity of infestation occur in a single field if it comprises more than one type of soil. Infestation can be avoided or minimised by sowing lucerne that is to be left for seed in rows about two feet apart at intervals

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of 4–8 ins. so as to expose the plants to the light and sun and keep the soil between the rows dry. Lucerne so cultivated also gives a considerably higher yield of seed in damp years. A good yield of seed is sometimes obtained from a heavily infested field if the flowers are abundant and properly pollinated.

In the second half of 1944, from July onward, lucerne was attacked by 14 species of bugs, a list of which is given. The more important were the Mirids, *Adelphocoris seticornis*, F., *A. lineolatus*, Goeze, *Calocoris norvegicus*, Gmel., *Lygus pubescens*, Reut., *L. pratensis*, L., *Deraeocoris ruber*, L., and *Plagiognathus chrysanthemi*, Wolff; they caused the flowers and pericarps to shrivel and drop, and such seeds as formed were small. Lucerne sown in rows was less infested, probably because the bugs were dislodged by the wind and exposed to other unfavourable factors.

In contrast to *Contarinia medicaginis*, *C. onobrychidis*, Kieff., which infests sainfoin [*Onobrychis sativa*] was more abundant in 1943 and 1944 than it had been in the preceding damp years.

GRADOJEVIČ (M.). **Boj proti kobylkám na Černé Hoře v r. 1946.** [Control of Locusts in Montenegro in 1946.]—*Ochr. Rost.* **19–20** pp. 46–49. Prague, 1948. (With a Summary in Russian.)

A severe outbreak of *Dociostaurus maroccanus*, Thnb., which had been breeding undisturbed during the four preceding years, occurred in April–June 1946 in south-eastern Montenegro over an area of about 300 sq. miles extending from the Albanian frontier to Danilovgrad. Cereals, vegetables and tobacco were attacked. Millions of hoppers of the first three instars were driven into massed heaps and destroyed, but this failed to check the outbreak. Adults appeared in the second half of May, and baits of wheat bran poisoned with arsenicals proved very effective against them and the young hoppers. These baits were applied at a number of points over the infested area, as well as in the adjoining districts in Albania where *D. maroccanus* was also abundant, and were also used successfully against *Calliptamus* (*Caloptenus*) *italicus*, L., an outbreak of which occurred in May and June near Danilovgrad.

KRATOCHVÍL (J.). **Málo známý škůdce sušené papriky, zeleniny a léčivých bylin.** [A little known Pest of dried Peppers, Vegetables and medicinal Herbs.]—*Ochr. Rost.* **19–20** pp. 49–54. Prague, 1948. (With a Summary in Russian.)

Larvae of the Geometrid, *Sterrha inquinata*, Scop. (*Acidalia herbariata*, F.) have for several years caused serious damage to dried vegetables and medicinal herbs in stores and collections at Brno (Moravia), and in 1945 were found to have destroyed large collections of dried peppers (*Capsicum*) of different kinds ranging from the hottest to the sweetest varieties. The whole fruits were frequently reduced to frass even though enclosed in cellophane bags. The leaves and stalks were much less damaged, but the ground fruits were readily infested in cellophane bags or tin boxes; several generations developed in the ground fruits of hot peppers in closed tins without other food or water.

The heavy infestation in the collections indicated that the moth could develop in pepper stores and mills, and since vegetables and medicinal plants are also dried and stored in such mills, the extent to which the larvae would attack different kinds of dried vegetables was investigated in the laboratory by observations on batches of 50 larvae of different instars placed in petri dishes, of which each contained a piece of dried sweet pepper of the kind most favoured by the larvae and a piece of one or more of the 11 different kinds of dried vegetables tested. No definite conclusions were drawn, as successive generations

of the moth were not observed, but the evidence indicated that the dried aerial parts of cabbage, celery and parsley were preferred to the fruits of peppers and beans, and the latter to the underground parts of onions, turnips, celery and carrots. Sugar peas and pepper seeds were not attacked at all. A complete generation developed in the laboratory between January and mid-April, so that four generations a year might be produced under favourable conditions.

Kac (A.). **Poznámky k speciální akci s hubením můry osenní.** [Notes on special Control Measures against the Winter Crops Noctuid.]—*Ochr. Rost.* **19–20** pp. 87–88. Prague, 1948. (With a Summary in Russian.)

Šíp (V.). **Škody způsobené osenicí na bramborách v r. 1944.** [Injuries to Potatoes caused by the Winter Crops Noctuid in 1944.]—*T.c.* pp. 88–90, 1 fig. (With a Summary in Russian.)

It is stated in the first of these papers that much damage to vegetables and other cultivated plants is caused in Bohemia by the larvae of *Agrotis segetum*, Schiff., and serious losses of crops occurred in 1943. The examination of the soil to a depth of 2–4 ins. at different sites during the ensuing winter showed that hibernating larvae were nowhere numerous, which is attributed to the action of partridges and pheasants, but that their general condition was good. They had not entered hibernation when the soil was very wet, but were present in some places where three feet of snow remained on the ground for two months. They pupated without supplementary feeding in the spring of 1944.

It is recorded in the second paper that larvae of *A. segetum* seriously injured the tubers and roots of potato in a number of districts in Bohemia in 1944, causing the plants to wither. The heaviest infestation occurred in fields that had been manured with dung, which had attracted the moths at the time of oviposition. The control measures recommended are the destruction of the larvae and the withering potato plants, and proper cultivation of the soil. The numbers of the hibernating larvae are reduced in warm wet winters by the action of fungi.

Osvald (V.). **Rozšíření přirozených nepřátel svilušky chmelové a jejich význam.** [The Distribution of the natural Enemies of the Hop Red Spider and their Importance.]—*Ochr. Rost.* **19–20** pp. 99–104, 1 fig. Prague, 1948. (With a Summary in Russian.)

Following dry warm weather in July and early August 1945, an outbreak of *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.) occurred on hops in Bohemia, and a survey of its natural enemies was carried out at the time of hop-picking in three infested districts in the north-west. As a rule, their abundance was in direct proportion to the severity of the infestation. They comprised predacious Staphylinids of the genus *Oligota*, which predominated in the least infested district, and also *Thrips flavus*, Schr., and Coccinellids of the genus *Scymnus*, both of which were numerous in the more severely infested ones.

These predators occurred only on the lower half of the plants and were scarce on the axillary leaves. They might be of value in some seasons during the early stages of plant growth up to the beginning of July, when the mite infests the leaves on the lower part of the vines, but could not control it if it had increased and spread to the upper part of the plants and to the axillary leaves. They are, however, of importance after the hops are picked, as they then attack the winter generation of the mite and thus reduce the likelihood of an outbreak in the following spring. This explains why infestation of hops by *T. telarius* is seldom heavy in two consecutive years.

KALANDRA (A.). **Důležitější a pozoruhodnější poškození, choroby a škůdci lesních dřevin v Čechách a na Moravě v letech 1942–1943.** [The most important and noteworthy Injuries, Diseases and Pests of Forest Trees in Bohemia and Moravia in the Years 1942–43.]—*Ochr. Rost.* **19–20** pp. 107–116. Prague, 1948. (With a Summary in English.)

This survey is similar to those of previous years [*cf. R.A.E.*, A **35** 101] and is based chiefly on reports and samples of material from Bohemia and Moravia. The warm and unusually dry weather in 1942 and 1943 favoured the development of various pests.

Bark-beetles increased greatly in numbers and attacked weakened and healthy trees that had been damaged by heavy snow in December 1939 and by winds; most of the fallen timber had been removed. On spruce, standing trees of which were sometimes killed by them, the two most important were *Ips* (*Pityogenes*) *chalcographus*, L., which was usually accompanied by *Polygraphus poligraphus*, L., and other species, and *I. amitinus*, Eichh., which spread considerably and was in some localities associated with the two foregoing species or with *I. typographus*, L. Other spruce pests included the sawfly, *Cephalcia abietis*, L. (*Lyda hypotrophica*, Htg.), of which there was a local outbreak, and *Hylastes cunicularius*, Er., which attacked the roots of seedlings. *Lymantria monacha*, L., was not injurious.

Pines (*Pinus sylvestris*) were comparatively free from the usual pests. *Myelophilus* (*Hylesinus*) *piniperda*, L., and to a less extent *M.* (*H.*) *minor*, Htg., were abundant on dry trees in the damaged areas, sometimes in association with *Pissodes* spp. and *I.* (*Pityogenes*) *quadridens*, Htg., all of which infested the crowns, the Tortricid, *Rhyacionia* (*Evetria*) *resinella*, L., was common, and larvae of *Melolontha melolontha*, L. (*vulgaris*, F.) injured the roots of seedlings and young trees in sandy soil in 1943, when a large flight of the adults occurred. *Chermes* (*Pineus*) *strobi*, Htg., was common on the trunks of *Pinus strobus*.

Several severe outbreaks of *Tortrix murinana*, Hb., occurred on silver fir (*Abies alba*) and the trees killed by them were heavily infested by *Cryphalus piceae*, Ratz., *Pissodes piceae*, Ill., and *Ips curvidens*, Germ. *Chermes nordmannianae*, Eckstein (*Dreyfusia nüsslini*, Börn.) remained present in several localities. Die-back of larch trees 15 years old in several districts and 30–40 years old in one was due to attack by fungi combined with severe infestation by *Taeniothrips laricivorus*, Krat. & Farský, *Chermes viridis*, Ratz., and, in some places, *Coleophora laricella*, Hb.

Eulecanium (*Lecanium*) *coryli*, L., was common on yew (*Taxus baccata*), oaks were severely damaged by *Tortrix viridana*, L. [*cf.* **35** 331], and hornbeams (*Carpinus betulus*) by *Coleophora fuscedinella*, Zell. A severe outbreak of *E. coryli* on ash (*Fraxinus excelsior*) occurred in flooded forests in two localities in Moravia, as a result of which the trees dried up [*cf.* **36** 65], and some defoliation was caused by the sawfly, *Tomostethus nigritus*, F. *Cryptorrhynchus lapathi*, L., increased greatly on cultivated American willow, causing much damage, particularly in Moravia [*cf.* **35** 102].

Hylotrupes bajulus, L., destroyed the timber of a roof, and the wooden floor of a new building was damaged by the larvae of *Tetropium castaneum* ab. *luridum*, L.

KRATOCHVÍL (J.), ROZSYPAL (J.) & DVOŘÁK (K.). **Zkušenosti s některými přípravky na ochranu rostlin v době vegetačního klidu.** [Experiments with certain Preparations for the Protection of Plants during the Period of vegetative Rest.]—*Ochr. Rost.* **19–20** pp. 116–129, 1 ref. Prague, 1948. (With a Summary in Russian.)

Following experiments in other parts of Czechoslovakia [*R.A.E.*, A **35** 102; **36** 288], laboratory, greenhouse and field tests were carried out at Brno in 1941–43

on dormant sprays for use on fruit trees. Most of the work was done with the winter eggs of *Paratetranychus pilosus*, C. & F., and *Lepidosaphes ulmi*, L., but eggs of *Psylla mali*, Schm., and young nymphs of *Eulecanium* (*Lecanium*) *coryli*, L., were also included. The results are shown in tables and discussed, but most of the materials tested were proprietary preparations, and the concentrations of active ingredients in these are not given.

Most of several preparations of dinitro-ortho-cresol gave high mortality of the various pests provided that the relative humidity was high. *Lepidosaphes* was somewhat more and *Psylla* considerably less resistant than *Paratetranychus* or *Eulecanium*. It is concluded that these sprays are effective at sufficiently high concentrations, and they should be applied as late as possible before bud-burst as their effect is increased by high temperature and humidity. They did not injure the buds, even of susceptible trees such as apricot and peach, and also control pests that migrate to the trees in spring.

The tar distillates (carbolineums) tested were of the heavy-oil type and were applied at the usual winter strength. They were more effective under dry than under damp conditions and gave at least 92, 95 and 90 per cent. mortality of *Paratetranychus*, *Psylla* and *Lepidosaphes*, respectively, in field tests when the trees were protected from rain. Mineral oils gave good control of the first two in the greenhouse, but proved disappointing in the field. When dinitro-o-cresol was combined with a tar distillate without reducing the strength of either, excellent control of all three pests resulted.

In greenhouse tests, sprays of 20 per cent. kainit or ferrous sulphate, 5 per cent. barium sulphate or 1 per cent. colloidal sulphur gave poor control of *Paratetranychus* and *Psylla*.

Blattný (C.) & others. **Drobné zprávy.** [Small Notes.]—*Ochr. Rost.* **19–20** pp. 158–165, 1 fig. Prague, 1948.

It is recorded in the course of these notes on insects and other pests in Czechoslovakia that when grain infested by *Calandra granaria*, L., was removed from a loft in November 1944, adults of this weevil migrated to the ground floor of the building and fed on apples laid out on a box. They made deep pits in the area of the calyx and penetrated to the core through or along the calyx channel.

Earwigs (*Forficula auricularia*, L.), caused considerable damage to fruits of apple and pear on the trees by eating out small shallow pits, chiefly at points where two fruits, or a fruit and a leaf, came in contact. In the damp spring of 1944, the nymphs fed intensively and chiefly at night on the leaves of beans, tobacco, dill, parsley, carrots and cabbage and slightly on those of turnip, peppers [*Capsicum*], tomato, maize, onion, garlic and ornamental plants. Dusts and sprays of DDT gave some control, particularly on carrots and parsley, but were less effective than a nicotine spray. The latter also gave good results against the Aphid, *Anuraphis* (*Yezabura*) *crataegi*, Kalt., on the roots of carrots and parsley when applied to the soil round the plants. The apple Aphid, *Aphis pomi*, Deg., spread considerably and was abundant in 1944; it causes blistering and curling of the edges of the leaves and stunting of the fruits.

Quadraspidiotus (*Aspidiotus*) *perniciosus*, Comst., was identified in the spring of 1944 on apple fruits sent to Prague from Würtemberg, Germany, where they had been grown.

Příhoda (A.). **Zezelenávání a zlistnatění květů švédského jetele**—*Trifolium hybridum* **L.** [Greenness and Malformation of the Flowers of Alsike Clover.]—*Ochr. Rost.* **19–20** pp. 135–138, 1 fig. Prague, 1948. (With a Summary in Russian.)

Numerous plants of alsike clover (*Trifolium hybridum*) grown for seed in a locality in Bohemia in 1944 were observed to have abnormally long pedicels

each terminating in a green flower-head that resembled a tuft of minute clover leaves. These flowers did not produce seeds, and examination of affected plants showed that larvae of the weevil, *Apion seniculum*, Kby., occurred in the lower part of the stems of all of them, whereas plants that had normal flowers were free from infestation. Similarly affected clover plants were also observed in pastures and strips of land between fields, and invariably harboured small larvae, though it was impossible to identify them. Elsewhere, *Trichomalus* sp., a Pteromalid parasite of the larvae of *A. seniculum*, was bred from alsike clover. From analogy with what is known to occur in some other plants, it is concluded that the infestation was the cause of the abnormality [*cf.* next abstract].

Příhoda (A.). **Importance de quelques représentants du genre *Apion* pour la botanique et l'agriculture (Col. Curculionidae).** [*In Czech.*]—*Acta Soc. ent. Čsl.* **45** no. 1–2 pp. 64–69, 11 refs. Prague, 1948. (With a Summary in French.)

The author reviews various instances recorded in the European literature of malformations of plants caused by the presence in the roots or stems of insect larvae, notably those of weevils of the genus *Apion* [*cf. R.A.E.*, A **18** 699], and states that in Czechoslovakia, branching and a tufted green condition of the flowers of alsike clover (*Trifolium hybridum*) and sometimes of red clover (*T. pratense*) have been found to be associated with the presence in the lower part of the stalks of larvae of *A. tenue*, Kby., and in one area of *A. seniculum*, Kby. [*cf.* preceding abstract].

Patočka (J.). **Quelques notices sur l'écologie d'un tortricide *Epiblema proximana* H. S. (Lep. Tortric.).** [*In Czech.*]—*Acta Soc. ent. Čsl.* **45** no. 1–2 pp. 89–94, 19 figs. Prague, 1948. (With a Summary in French.)

Eucosma (*Epiblema*) *proximana*, H. S., which closely resembles *E.* (*E.*) *tedella*, Cl., is an important pest of silver fir [*Abies alba*] in Czechoslovakia, but little is known of its habits. Observations on it were therefore carried out at the end of April and in the second half of June 1947 in forests in several districts in Moravia and southern Bohemia and supplemented in the laboratory. The adults were numerous in both months on the branches of fir trees and also occurred on the trunks. The size of the trees appeared to be of little importance; both larvae and adults were observed in the tops of old firs, though young stands were preferred. In mixed forests of fir and spruce, *E. proximana* was confined to fir and *E. tedella* to spruce. No eggs were found in nature, but captive females oviposited at the end of June laying 10–18 eggs singly on the needles, usually on the upper surface. The eggs are described. The larvae hatched in 8–14 days and bored into the needles, mining from the apex to the base. They did not attack spruce needles and died when no other food was available, whereas those of *E. tedella* attacked both spruce and fir [*cf. R.A.E.*, A **23** 740]. After having hollowed out one needle, the larva leaves it, joins several others together with a fine web and spins a silk shelter among them, in which it feeds on the enclosed needles. The larvae of *E. tedella* mine in the needles from the base to the apex and join them with a web but do not spin a shelter. The larvae of *E. proximana* descend on silk threads to the ground about the end of October (at least 15 days earlier than those of *E. tedella*) where they hibernate, and pupate in spring. Needles of the previous or earlier years, are usually infested, seldom the young shoots. A table is given showing the chief morphological characters of the adults, larvae and eggs of the two species, together with their feeding habits; they are most easily distinguished by the latter.

Laidlaw (W. B. R.). **On the Appearance of the Bark-beetle *Ips typographus* in Britain on imported Timber with Notes on preventive and control Measures.**—*Forestry* **20** pp. 52–56, 1 pl., 3 figs., 4 refs. London, 1947.

Consignments of unbarked and imperfectly barked logs of Norway spruce [*Picea abies*] and in two instances unbarked logs of Scots pine [*Pinus sylvestris*] from Germany that arrived at various ports in Great Britain in the summer of 1946 were found on arrival to be heavily infested by *Ips typographus*, L., a bark-beetle that is not established in Britain. Larvae and pupae predominated in June and adults in July. Other insects found on the spruce logs were *Hylastes palliatus*, Gyllh., a small beetle predacious on it, and a species of *Rhizophagus* predacious on *Ips*, and those on the pine logs comprised *I. sexdentatus*, Börn., *Myelophilus piniperda*, L., a few Chalcidoid parasites of *Ips*, and *Rhizophagus* sp., a small Carabid and one example of *Thanasimus formicarius*, L., all three of which are predacious on *Ips*.

The distribution and food-plants of *Ips* spp. in Britain and the bionomics of *I. typographus* are reviewed from the literature; in Sweden, the latter is regarded almost as a primary pest of spruce, since it will attack trees that are only very slightly reduced in vigour. In view of the danger that it might become established in Britain, precautionary measures were at once taken. All timber merchants that received the infested logs were asked to remove and burn the bark from all unbarked spruce, or if the timber was due for almost immediate conversion, to burn the slabwood bearing the bark. In addition, when mills receiving the timber were situated outside large towns and near coniferous woods, the owners were asked to lay trap-logs of green Norway spruce on or beside the imported logs, and to burn any trap-logs that had become infested 6–8 weeks later. Up to October 1946, no examples of *Ips* had been taken in trap-logs, and in only one instance were any beetles found, these comprising *Hylastes ater*, Payk., and *Rhizophagus* sp. Instructions were given in Germany for the barking of all spruce before shipment.

Hughes (A. M.). **The Mites associated with stored Food Products.**—[2+] 168 pp., 250 figs., 19 refs. London, Minist. Agric. Fish., 1948. (From H.M. Stationery Office, price 3*s*.)

This work deals with the systematics of mites found in association with stored food products in Britain and Northern Ireland, including those that attack the products, others that are predacious on them, and some that feed on small fungi or are parasitic on insects and rats. The bulk of it consists of descriptions of the adults and, in some cases, the immature stages of some 46 species, of which 14 are new and for one of which a new genus is erected, with notes on their habits and bionomics where these are known. Keys to the various groups and species are included. A brief introductory chapter contains general information on the morphology of the Acarina and the collection and preservation of mites, and formulae for preserving and mounting specimens are given in an appendix.

Salt (G.) & Hollick (F. S. J.). **Studies of Wireworm Populations. II. Spatial Distribution.**—*J. exp. Biol.* **23** no. 1 pp. 1–46, 4 figs., 20 refs. London, 1946.

Examination by the method described in the first paper of this series [*R.A.E.*, A **32** 306] of soil samples collected once a month between January 1942 and April 1944 at 20 points in a grass field of eight acres near Cambridge showed that wireworms (almost entirely *Agriotes sputator*, L.) were not distributed at random. Their distribution showed a highly significant negative correlation with the organic content of the upper soil as measured by loss of

weight on ignition of the oven-dry soil, the content of organic carbon and nitrogen, the prevalence of the grass *Lolium perenne*, and the numbers of Staphylinid larvae and of Nematocera (not including the Sciarinae) present, and a highly significant positive correlation with the prevalence of the grass *Agrostis stolonifera*, and the numbers of centipedes, which may prey on wireworms, and ants; it was correlated negatively to a significant degree with altitude and positively with the pH of the soil and the population of millepedes. Of these factors, the loss of weight of the soil on ignition, the prevalence of *Lolium* and the numbers of Staphylinid larvae appeared to be the most important, though the correlation is probably due to avoidance of *Lolium* rather than of organic matter in the soil.

The numbers of wireworms found in soil samples collected at 16 points in a grass plot of a quarter of an acre once a month from July 1941 until September 1942 and in extra samples collected in June, July and August 1942 and in May, June and July 1944 showed that distribution was markedly non-random throughout the sampling period, some positions being consistently three or four times as heavily infested as others only five yards away. This field was much wetter than the other and contained much higher proportions of lime and organic matter, and the distribution of wireworms was correlated positively with altitude and depth of loam and negatively with the amount of soil moisture at depths of 3 and 9 ins. to highly significant degrees, and negatively with the lime content of the soil to a significant degree. Buttercup (*Ranunculus*) was prevalent on an area of low wireworm infestation, but the correlation was not significant, and the apparent association may be due to a positive relation between soil moisture and abundance of *Ranunculus*. Among the factors studied in this plot, the amount of soil moisture at a depth of 3 ins. was most important, altitude and depth of loam being significant because they affected this. Within the plot, high wireworm populations consisted almost entirely of *A. sputator*, whereas low ones were made up of about equal numbers of this species and *A. obscurus*, L., or *A. lineatus*, L., which were not separated. Comparison of the result of the two tests indicated that although wireworms are indifferent to low concentrations of chalk, they may tend to avoid it when its concentration reaches 20–30 per cent., and that they do not avoid organic matter in the soil.

In order to obtain information on the micro-distribution of wireworms, two samples were examined from each of the fields in which the other tests were made. Each of them comprised all the soil from an area of one square yard, removed to a depth of 6 inches in 81 separate parts, each 4 inches square. Within each square yard, the wireworms were not distributed at random and independently, but were markedly aggregated. Separation of the wireworms collected from these samples into three size groups representing larvae nearly a year old, 2–3 years old and 3–4 years old showed that the non-random distribution was largely due to the small larvae, which were strongly aggregated. The medium-sized larvae were less markedly aggregated, and the distribution of the large larvae under grass was not significantly different from a random distribution. This indicates that the larvae are gathered in groups when they are young, doubtless owing to the habit of the females of depositing a number of eggs near together in a selected place, but gradually disperse.

From the results obtained, it is concluded that wireworms cannot be assumed to be distributed at random and that spatial distribution and seasonal distribution are inseparable, any study of one without the other being incomplete.

The geographical distribution of *Agriotes* spp. in Britain is discussed in a final note. They are not important pests in the northernmost counties of England, and become increasingly rare further to the north. Consideration of their life-history, what is known of their temperature relationships and the climate suggests that their northern limit is set by the minimum temperature

required for pupation. Since *A. sputator* is the dominant species in the east and south-east of England, where the climate is driest and wireworm populations as a whole are highest [*cf.* **33** 265], there appears to be a general agreement between high wireworm populations, the prevalence of *A. sputator* and low moisture.

PUSSARD (R.). **Nouveaux insecticides et traitements de l'oeillet.**—*C.R. Acad. Agric. Fr.* **32** no. 16 pp. 695–699, 1 ref. Paris, 1946.

The principal Arthropod pests of carnations grown in greenhouses on the French Riviera are wireworms, thrips, *Tortrix* (*Cacoecia*) *pronubana*, Hb., Noctuid larvae, and *Tetranychus telarius*, L. [*cf. R.A.E.*, A **22** 509]. In the summer of 1946, experiments were carried out to compare sprays and dusts of DDT and BHC (benzene hexachloride) with sprays of nicotine sulphate for their control. In a separate experiment against wireworms (*Agriotes*) that were damaging carnations in one greenhouse, BHC was mixed with mould and hoed into the soil at the rate of 0·018 oz. pure BHC per sq. yd. Five days later, dead wireworms were found in the soil and no further plants were killed, whereas destruction of the controls continued. The BHC had no harmful effects on the growth of the plants.

The leaves of carnation are difficult to wet, but experiments have shown that satisfactory initial retention is given by liquids containing at least 0·2 per cent. of certain proprietary wetting agents that are based on sulphated terpene alcohols. In the main tests, which were conducted in widely separated plantings, the sprays used were 1 and 2 per cent. suspensions of a wettable powder containing 10 per cent. BHC or of one consisting of 5 per cent. DDT adsorbed on a carrier, with an adhesive and a wetting agent, to all of which was added 0·2 per cent. of an additional wetting agent containing sulphated terpene alcohols ; 0·25 and 0·5 per cent. of a 20 per cent. solution of DDT emulsified in water ; and 0·25–0·375 per cent. nicotine sulphate with 0·2 per cent. of the wetting agent and 0·8 lb. sodium carbonate crystals per 100 gals. spray. The dusts contained 4 per cent. DDT (in talc) or 8 per cent. BHC. The sprays were applied at rates of 3–7 pints per 10 sq. yards and the dusts at just over 1 oz. per 10 sq. yards. In all, 13 applications of each treatment were made between 14th June and 11th October ; the intervals between them were 10–15 days, except in August, when they were reduced to a week in view of the sudden increase of thrips in the warmer weather.

The results showed that the weaker BHC spray was very effective against thrips, did not stain the foliage and had a beneficial effect on the growth of the plants ; *Tortrix* increased noticeably on plots treated with BHC and not on those that received other treatments. The weaker DDT suspension was effective against thrips, *Tortrix* and Noctuid larvae, and plant growth was superior to that in plots sprayed with nicotine but *Tetranychus* increased. The emulsified solutions of DDT were as effective as the suspensions against thrips and *Tortrix*, even at a concentration of 0·25 per cent., but seriously affected the waxy bloom on the leaves and favoured the increase of *Tetranychus* ; when the treated flower-stems were syringed with water or dipped into it, the green parts assumed an abnormal yellowish tinge, but it disappeared after drying. This treatment also appeared to weaken the plants, which became more sensitive to other insecticides. The DDT and BHC dusts were very effective against thrips, and the dusted plants, particularly those treated with BHC, were far more vigorous than those sprayed with nicotine sulphate. The latter gave only moderate thrips control, and though nicotine sprays are favoured by growers because they also give partial control of *Tortrix* and *Tetranychus*, the author considers that they could with advantage be replaced by BHC dusts, applied at intervals of at least 8–10 days ; these would be easier

to apply, and the residue is almost invisible. A mixture of BHC and DDT would give a very effective combined treatment against thrips and *Tortrix*, provided that supplementary applications of an acaricide were made for the control of *Tetranychus*.

Organic insecticides applied to carnations are not likely to poison bees, because carnations are not often visited by them and the hives are normally transferred to the mountains from June to October, when the treatments are applied ; in any case, all open blossoms should be cut twice a day, whether marketable or not.

DAVATCHI (A.). **Note sur les Bruchides nuisibles aux légumineuses en Iran.** [*In Persian.*]—*Ent. & Phytopath. appl.* no. 2 pp. *1–8*, 3 pls., 3 refs. Teheran, 1946. (With a Summary in French, pp. 1–2.)

The adults of *Bruchus pisorum*, L., *B. lentis*, Froel., and *B. rufimanus*, Boh., are described, and notes are given on their bionomics. They are all common in Persia, where they have one generation a year, and are particularly injurious in the vicinity of Teheran. *B. pisorum* attacks peas in almost every area in which they are cultivated, *B. lentis* causes much damage to lentils and was found infesting more than 80 per cent. of an entire crop at Karadj, and *B. rufimanus*, which is known to be polyphagous, infests only broad beans, causing considerable losses in northern Persia as well as near Teheran. Lentil seeds attacked by *B. lentis* almost always lose their germinating power, as most of the nutritive matter in them is consumed, but broad beans infested by one or two Bruchids are still able to germinate, though many of those attacked by three or more are not.

The control measures recommended include harvesting as soon as the crops are mature, followed by deep ploughing after harvest ; storage of seed in containers from which the beetles cannot escape ; annual disinfestation of storage sheds, and the use of uninfested or treated seeds for sowing. Fumigation with carbon bisulphide at 1–2 oz. per 10 cu. ft. or with hydrocyanic acid gas from 2–4 oz. calcium cyanide per 100 cu. ft. are recommended for seed treatment, but, if this is impossible, seed for sowing should be kept in store for two years so that it becomes free from infestation.

KAUSSARI (M.). *Pectinophora gossypiella* **Saund. (Lep. Gelechiidae).** [*In Persian.*]—*Ent. & Phytopath. appl.* no. 2 pp. *9–12*. Teheran, 1946. (With a Summary in French, p. 3.)

Enquiries have shown that *Platyedra* (*Pectinophora*) *gossypiella*, Saund., which was recorded on cotton at Bandar Abbas in southern Persia in 1937 [*R.A.E.*, A **28** 96], was originally imported in cottonseed from Egypt in 1934. It has not spread beyond a few localities in southern Persia, owing to the limited extent to which cotton is grown there, the extensive deserts and high mountains that separate Bandar Abbas from the other cotton-growing districts, and the measures taken [*loc. cit.*] ; most of the cottonseed produced in the area is fed to cattle. The fact that up to four larvae have been found in single bolls suggests that the insect is not attacked by parasites in Persia. Subsequent investigations showed that it was also present in Charbar, where it was probably introduced in cottonseed from India.

KIRIUKHIN (G.). **Les parasites du** *Chrysomphalus dictyospermi* **Morg. au nord de l'Iran.** [*In Persian.*]—*Ent. & Phytopath. appl.* no. 2 pp. *13–22*, 2 pls., 1 map, 3 refs. Teheran, 1946. (With a Summary in French, pp. 4–6.)

Although *Citrus* and other plants are heavily infested by *Chrysomphalus dictyospermi*, Morg., in northern Persia [*cf. R.A.E.*, A **36** 386], up to 95–99

per cent. control is effected periodically by parasites. The most important of these are the Aphelinids, *Aphytis chrysomphali*, Merc., var. *mazandaranica*, n., and *Prospaltella fasciata*, Malenotti, and the fungus, *Fusarium juruanum* [*cf. loc. cit.*]. Descriptions in French and Persian are given of the adults and pupae of both Aphelinids and of the larvae *A.c. mazandaranica*. The latter is particularly abundant in the region of Chahsavar on the Caspian coast but is rare at Resht and does not occur at Bandar-Pehlevi. In 1944, parasitism by it, particularly of the second generation of *C. dictyospermi*, was very high from Lahijan to Gorgan, but in 1945 it did not become active until late in the season, with the result that damage to *Citrus*, particularly by the second and third generations of the Coccid, was severe. Good control was again effected in 1946. *P. fasciata* has a limited range and occurs chiefly in the regions of Chahsavar-Ramsar and Lahijan.

Davatchi (A.). **Note complémentaire sur** *Saissetia oleae* **Bern.** [*In Persian.*] —*Ent. & Phytopath. appl.* no. 2 pp. *26–27*. Teheran, 1946. (With a Summary in French, p. 8.)

Further investigations on the occurrence of *Saissetia oleae*, Bern., in northern Persia [*cf. R.A.E.*, A **36** 385] have shown that it was imported in 1916 on young plants of oleander (*Nerium oleander*) from Russia. Oleander in gardens at Bandar-Pehlevi and at Pir-Ali-Bagh was severely infested, but wherever it occurred the Coccid was extremely heavily attacked by the fungus, *Cephalosporium lecanii* [*cf. loc. cit.*], which probably explains the slowness with which it has become established in the northern provinces. Observations have shown that it has two generations a year in the province of Gilan. Quarantine measures have been taken to prevent it from spreading to olive groves south of Resht.

Kiriukhin (G.) & Taghi-Zadeh (F.). *Pulvinaria aurantii* **Ckll.** [*In Persian.*] —*Ent. & Phytopath. appl.* no. 2 pp. *28–29*, 1 pl. Teheran, 1946. (With a Summary in French, p. 9.)

Pulvinaria aurantii, Ckll., was found on *Citrus* for the first time in Persia at Resht and Bandar-Pehlevi in 1946. The climate of these districts is unfavourable for it, as in some years the leaves and branches of *Citrus*, and sometimes even entire trees, are killed by the winter cold, and the fungus, *Cephalosporium lecanii*, which attacks it very heavily, occurs there. Its spread to Mazandaran and Gorgan would be dangerous, as the climatic conditions there would favour its multiplication.

Characters distinguishing *P. aurantii* from *P. floccifera*, Westw., which also attacks *Citrus* in northern Persia [*cf. R.A.E.*, A **36** 387], are shown in a table.

Hawboldt (L. S.). **Forest Entomology.**—*Rep. Dep. Lds For. N.S. 1946* pp. 35–50, 1 map. Halifax, N.S., 1947. *Op. cit. 1947* pp. 34–46. 1948.

These two reports deal with the status of forest insects in Nova Scotia in 1946 and 1947, respectively. *Hemerocampa leucostigma*, S. & A., which was not abundant in 1945 [*cf. R.A.E.*, A **35** 302], was the most active of all the forest insects in 1946, and caused widespread damage ; the many species of trees attacked included apple, cherry, birch, willow and poplar, and serious defoliation was observed on conifers. Further but less serious outbreaks occurred in 1947 throughout the mainland. *Gilpinia hercyniae*, Htg., was active on spruce in many localities in both years, but infestations were light

and were generally controlled by disease [*cf.* **35** 301] and introduced parasites. A small local infestation of spruce by *Dendroctonus piceaperda*, Hopk., was observed in the Cape Breton Highlands National Park in 1946, and a heavy attack was discovered at Clemensport, where dead trees were observed over a large area during an aerial survey ; in 1947, inspection of an outbreak at McKinnon Neck revealed that 10–15 per cent. of the trees were dead. Infestation of the stems of balsam fir [*Abies balsamea*] by *Chermes* (*Adelges*) *piceae*, Ratz., increased in both years, while twig infestations (gout) [*cf.* **21** 283] still persisted. In 1946, mortality of branches and twigs of *A. balsamea* occurred throughout the Province, due to attacks by *Chermes*, a needle rust (probably *Chrysomyxa* sp.), and feeding by adult sawyer beetles [*Monochamus*]. Injurious outbreaks of *Malacosoma disstria*, Hb., occurred on stands of young poplar and white and grey birch [*Betula papyrifera* and *B. lutea*] in 1946 ; they were less extensive in 1947, but apple and plum were also defoliated in that year. Considerable mortality of oaks in western districts was largely attributed to severe attacks by *Alsophila pometaria*, Harr., over the preceding ten years. Damage to larch by *Coleophora laricella*, Hb., was generally light in both years [*cf.* **35** 301], although heavy in a few areas. *Stilpnotia salicis*, L., caused complete defoliation of ornamental poplars in Margaree Forks in 1946 and at Amherst and Springhill, Cumberland County, in 1947, when numerous cocoons of a parasite, *Apanteles* sp., were found.

Other insects recorded in both years include *Fenusa pusilla*, Lep. (*pumila*, Klug) and *Phyllotoma nemorata*, Fall., of which the former was the more injurious, on birch, *Zeiraphera fortunana*, Kearf., and *Z. ratzeburgiana*, Ratz., which were injurious to new spruce shoots, *Haltica* (*Altica*) *ambiens* var. *alni*, Harr., which completely destroyed alder foliage in many sections of the Province, and *Pristiphora geniculata*, Htg., which was particularly active on ornamental and forest mountain ash [*Sorbus aucuparia*] in 1947. Further work on the dieback of birch [*cf.* **35** 302] indicated that the bronze birch borer [*Agrilus anxius*, Gory] rarely becomes established in a tree until this has already reached a stage in which some of the branches of the crown are dead. Only a few larvae of the form of *Harmologa* (*Archips*, *Choristoneura*) *fumiferana*, Clem., that attacks *Abies balsamea* and spruce were taken in either year, all on Cape Breton Island, but it is pointed out in the second report that although this Tortricid is not at present abundant in the Province, outbreaks are in progress in neighbouring parts of Canada and the United States, so that precautions are necessary. It is thought that susceptibility to attack increases with the amount of *A. balsamea* and spruce per acre, the percentage of *A. balsamea* and the age of the stand. A method of classification of the susceptibility of a stand based on these criteria is outlined.

Parasites liberated during 1946 comprised *Chrysocharis laricinellae*, Ratz., and *Agathis* (*Bassus*) *pumila*, Ratz., in one county against *Coleophora laricella*, and *Sturmia* sp. in five against *G. hercyniae*.

FRIEND (W. H.). *Citrus* **Orcharding in the Lower Rio Grande Valley of Texas.** —*Circ. Tex. agric. Exp. Sta.* no. 111, 38 pp. College Station, Tex., 1946.

This circular includes a section (pp. 28–31) in which notes are given on the Arthropods that attack *Citrus* in the Lower Rio Grande Valley of Texas. Rust mites [*Phyllocoptruta oleivorus*, Ashm.] cause some damage every year from about 15th March to 1st July, but are usually controlled by applications of 40–60 lb. finely ground sulphur per acre at intervals of 30 days during this period. Tetranychid mites often cause injury during the autumn, though this is not serious unless very dry winds occur ; excessive defoliation is usually confined to orchards in which autumn irrigation is neglected. The California

red scale [*Aonidiella aurantii*, Mask.] has occasionally caused defoliation, loss of branches and complete loss of the fruit crop, but during the past ten years, natural control by fungi and several insect parasites and predators has been effective against all the scale insects and whiteflies that infest *Citrus* in the Lower Rio Grande Valley. In dusty areas along road margins or in orchards that are dusted or sprayed too frequently, however, Coccids sometimes cause loss of fruit and weaken the trees, and such trees should be sprayed with summer oil emulsion or miscible oil (1·25–1·5 per cent. actual oil) between 1st May and 1st August against *A. aurantii*, the Florida red scale [*Chrysomphalus ficus*, Ashm.], the purple scale [*Lepidosaphes beckii*, Newm.], the chaff scale [*Parlatoria pergandei*, Comst.], the soft brown scale [*Coccus hesperidum*, L.] and whiteflies, or sprayed with oil emulsion and then dusted lightly with 5 per cent. DDT in talc against the cottony cushion scale [*Icerya purchasi*, Mask.].

Three ants occasionally injure *Citrus* trees in southern Texas. The cornfield fire ant [*Solenopsis geminata*, F.], which is usually most active during the autumn and damages the trees by eating the bark and sapwood, can be controlled by applying cyanogas calcium cyanide to the nests, if these are not too near the trees, or by using thallium-sulphate bait [*cf. R.A.E.*, A **20** 705]. The best treatment against fire ants that nest about the crown roots of *Citrus* trees is considered to be repeated dusting, at weekly intervals if necessary, with concentrated pyrethrum (1·3 per cent. pyrethrins). A light coat of a wash of copper sulphate and lime fortified with 5 per cent. tar distillate, known as plant-safe (1 per cent. phenol) carbolineum, is an effective repellent for use on the trunks of young *Citrus* trees, but soon loses its repellent properties and must be renewed. The use of a repellent on the trunks does not stop girdling below the ground line. The wood-tunnelling (acrobatic) ant [*Crematogaster*] frequently enters the tree at an improperly protected pruning wound or where a branch has died back to a main branch, and tunnels in the branches. It lives on fungi grown on moist plant material stored in the tunnels, and the presence of moist material within the body of the tree makes conditions favourable for the development and spread of rot-producing organisms, which may eventually cause the loss of large branches or the entire tree. This ant is best controlled by applying a wound paint of equal parts of asphalt and plant-safe carbolineum on all tree wounds, removing dead wood, and injecting small quantities of the carbolineum into the tunnels and then sealing them with the paint. The method of preparing the latter is described at the end of the circular. Leaf-cutting (parasol) ants [*Atta texana*, Buckley] may completely defoliate trees near their nests and are most troublesome in plantings close to brush land. They can be controlled only by making deep injections of fumigants such as carbon bisulphide or cyanide into the subterranean nests. The main nests may have a capacity of several hundred cubic feet, and as much as 1–2 lb. fumigant is required per colony. It should be put within or near the main nest, which may be 6-8 ft. below the surface of the soil, and the entrances sealed with mud to prevent the escape of the gas.

It is pointed out that great caution is necessary in selecting a treatment for ant control on *Citrus*, as the trees are severely injured by many kinds of wood preservatives, repellent paints and poisons, and also by fumigants applied near them.

Minor pests include Pentatomids and leaf-footed plant bugs [*Leptoglossus phyllopus*, L.], which occasionally cause excessive shedding of tangerines and early oranges during the autumn and may possibly be controlled by the use of some of the newer insecticides, such as sabadilla dust, and thrips and Aphids, which seldom require control, though the thrips cause some injury to fruit during the setting period.

Parker (R. L.) & Lamerson (P. G.). **Codling Moth Control with DDT, fixed Nicotine and Lead Arsenate Combinations.**—*Bienn. Rep. Kans. hort. Soc.* **48** pp. 68–75. Topeka, Kans., 1946.

The results are given of field experiments on the control of the codling moth [*Cydia pomonella*, L.] on apple in Kansas in 1944. In that season, adults of the overwintering generation emerged from 18th May to 10th July, and larvae of the first generation caused steady and consistent damage from 29th May to 10th July, though fair control was obtained in most orchards that received the required number of first brood sprays. In orchards in which control of the first generation was poor, the second generation caused severe damage from 10th July to 20th August, after which heavy rains and cool weather reduced activity. Warmer weather after 6th September resulted in higher catches of moths, and a late hatch of larvae of the second generation began about 15th September, though very few entries were attempted. There appeared to be no definite third generation.

The trees in the experimental plots received a calyx spray on 25th May and eight cover sprays of the materials to be tested on 30th May, 6th, 15th and 26th June, 12th and 24th July and 7th and 24th August, and also two early sulphur sprays for the control of scab [*Venturia inaequalis*] and two hormone sprays in September to prevent excessive fruit drop. All spray quantities are given per 100 U.S. gals. spray mixture, and 4 lb. lead arsenate was used for the calyx spray on all trees except those treated with DDT. Infested, superficially injured and uninjured dropped apples were recorded at intervals during the summer, 250 pre-harvest dropped apples per tree were collected and examined between 4th and 9th September and a harvest count of 250 picked fruits per tree was made on 21st September ; the percentage control was computed on a seasonal plot summary basis.

The percentages of fruit infested and (in brackets) superficially injured were 7·8 (21·1) for cover sprays of 4 lb. lead arsenate, 1·9 (20·6) for 4 lb. lead arsenate and 4 oz. zinc sulphate, with 1 U.S. quart summer-oil emulsion in the first four, and 2·4 (11·1) for the second schedule when the top third of the trees was sprayed again immediately after each regular spray had dried (top-off sprays). They were 4·9 (5·5) for a schedule of 4 lb. lead arsenate in the first cover spray, 3 lb. lead arsenate with 1½ lb. Black Leaf 155 [14 per cent. fixed nicotine] in the second, 3 lb. lead arsenate, 2 lb. Black Leaf 155 and 2 U.S. quarts oil in the third, and 2 lb. Black Leaf 155 with 2 U.S. quarts oil in the fourth to ninth, the extra spray being applied on 7th July, 6·8 (4·5) for one of 4 lb. lead arsenate, 4 oz. zinc sulphate and 1 U.S. quart oil in the first four cover sprays and 2 lb. Black Leaf 155 and 2 U.S. quarts oil in the fifth to ninth, and 25·6 (11·7) for calyx and cover sprays of 2 lb. DDT (as Gesarol A 20 spray concentrate [20 per cent. DDT with a wetting agent]). The DDT spray, which was said by the makers to contain too much of the wetting agent, gave good control of the first generation, but poor control of the second, and resulted in the production of less sound fruit and more infested fruit than any other treatment.

The foliage of all trees but those sprayed with lead arsenate alone was in good condition on 7th August, but foliage injury was evident in all plots by 14th August, though trees treated with lead arsenate and zinc sulphate were less injured than any others. The foliage of these was in good condition at harvest, when only 25 per cent. of the leaves remained on trees treated with lead arsenate alone. Damage to the leaves of the trees sprayed with DDT was due to a fairly heavy infestation by the common red spider [*Tetranychus*] that developed on them during late July and August ; examination of the leaves and trunks on 16th August showed that the mites were already beginning to hibernate. The pre-harvest fruit drop began on 1st–3rd September ; there was a marked tendency for trees treated with lead arsenate alone or DDT to drop their fruit first.

All samples of unwashed, stored harvest apples that had been sprayed with lead arsenate had more than the tolerance of 0·025 grain arsenic trioxide per lb. fruit on 8th November, and an acid wash did not reduce all the residues to below tolerance. The surface wax formation that occurs on stored apples increases the difficulty of residue removal. On 29th December, apples that had been sprayed with DDT had a residue of 0·001 grain DDT per lb.

HAMMER (O. H.) & SHERMAN III (F.). **Dormant Treatments for the Control of the Cherry Casebearer.**—*Quart. Bull. Mich. agric. Exp. Sta.* **29** no. 3 pp. 205–207. East Lansing, Mich., 1947.

Severe damage to sour cherry in Michigan is caused periodically by larvae of *Coleophora pruniella*, Clem., which live in cases and feed on the blossoms, fruits and leaves [*cf. R.A.E.*, A **20** 293]. They overwinter within their cases on the branches, usually clustered in the axils of spurs or buds, and migrate to the opening buds in spring. In 1946, which was an early season, their migration reached a peak between 19th and 24th April at Traverse City.

Experiments are described on the comparative effectiveness against the overwintering larvae of oil and dinitro compounds, which were applied separately or together on 20th and 21st March, 1946. Counts of larvae made on 4th and 5th June, near the end of the feeding period, showed that the percentages of control given were 92·9 for a miscible oil at a concentration of 5 per cent., which slightly retarded the buds ; 98·1 and 97·5 for 1·5 and 2 per cent. of a preparation containing 4 per cent. dinitro-ortho-cresol and a goulac-bentonite emulsifier in petroleum oil, which caused no injury ; 99·6 for 30 oz. of a wettable powder containing 40 per cent. dinitro-o-cresol with 2 U.S. gals. miscible oil in 100 U.S. gals. water, which caused some injury to the terminal buds ; 99·9 for 0·5 per cent. Elgetol (a slurry of sodium dinitro-o-cresylate containing about 7 oz. dinitro-o-cresol per U.S. quart) with 3 per cent. miscible oil, which caused the most injury ; 99 for 3 lb. per 100 U.S. gals. water of the powder containing 40 per cent. dinitro-o-cresol ; 99·8, 99·5 and 99·5 for 0·5, 0·75 and 1 per cent., respectively, of a solution of the triethanolamine salt of dinitro-o-secondary-butylphenol containing 8 oz. actual dinitro-o-butylphenol per U.S. quart ; and 99·2 for 0·75 per cent. of a solution of the ammonium salt of the same compound containing 8 oz. of the salt per U.S. quart. None of the preparations that did not contain oil caused any injury, except the one used at 1 per cent., which caused slight retardation of lateral buds and killed a few terminal ones. The preparation containing 4 per cent. dinitro-o-cresol in petroleum oil controlled the black cherry Aphid [*Myzus cerasi*, F.] at 1·5 per cent.

It is emphasised that complete cover is essential for the control of *C. pruniella*, and that none of the materials discussed is effective without it.

MCNAMARA (B. P.) & KROP (S.). **Observations on the Pharmacology of the Isomers of Hexachlorocyclohexane.**—*J. Pharmacol.* **92** no. 2 pp. 140–146. 1948. (Abstr. in *Bull. Hyg.* **23** no. 7 p. 535. London, 1948.)

Crude benzene hexachloride contains at least four spatial isomers, of which the γ isomer has the greatest insecticidal properties [*R.A.E.*, A **33** 256–257]. The β, γ and δ isomers show different toxicities to rabbits when administered intravenously in emulsified oil solutions. The chief pharmacological action of the γ isomer in rabbits and dogs is stimulation of the central nervous system. The β and δ isomers depress the central nervous system of rabbits, antagonising the central effects of the γ isomer. The crude mixture is therefore less potent than the pure γ isomer. This isomer gives a " grand mal " type of electro-encephalogram, bradycardia and a blood pressure rise in curarised dogs. Atropine blocks the bradycardia but not the pressor effect in such animals. Pentobarbital prevents the change in electroencephalographic pattern and

favours a fall in blood pressure, but does not prevent the bradycardia. Yohimbine hydrochloride inhibits the rise in blood pressure without blocking the central effects. Dibenzyl chloroethylamine hydrochloride (dibenamine) is less effective in this respect.

McNamara (B.) & Krop (S.). **The Treatment of acute Poisoning produced by Gamma Hexachlorocyclohexane.**—*J. Pharmacol.* **92** no. 2 pp. 147–152. 1948. (Abstr. in *Bull. Hyg.* **23** no. 7 p. 535. London, 1948.)

Pentobarbital and phenobarbital effectively antagonise the toxic effects of large intravenous and oral doses of γ benzene hexachloride in rabbits and dogs [*cf.* preceding abstract]. Symptomatic treatment gave best results in the case of oral poisoning, the recovery rate being more favourable when minimal narcosis was employed and the symptoms of central stimulation were not completely abolished. The ideal therapeutic régime would probably be attained by the administration of a small dose of phenobarbital followed by repeated doses of a short-acting barbiturate such as pentobarbital to control convulsive seizures. Artificial respiration and cardiac massage are valuable measures for respiratory and cardiac failure. Although there is some evidence that the γ isomer produces its effects by interfering with inositol metabolism [*cf. R.A.E.*, A **36** 277, etc.], the authors found that i-inositol gave little protection against poisoning produced by the intravenous injection of γ benzene hexachloride in rabbits.

Muggeridge (J.) & Dolby (R. M.). **Control Measures against the Cheese-mites, *Tyrolichus casei* Ouds. and *Tyrophagus longior* Gerv.**—*N.Z. J. Sci. Tech.* **28** (A) no. 1 pp. 1–30, 8 figs., 17 refs. Wellington, N.Z., 1947.

Cheese mites are normally of little importance in New Zealand as they are checked in bulk cheese stores by the low temperature (45°F.) at which the cheese is kept. It became likely during the war, however, that cheese for export would have to be stored at normal temperatures ranging up to 75°F., at which the mites might prove injurious. The important species are *Tyrolichus casei*, Oudm., and a species of *Tyrophagus* referred to as *T. longior*, Gerv. [*cf. R.A.E.*, A **36** 416], and experiments on the control of these were therefore carried out. The main results have already been noticed [**36** 244]. The waxes tested were butterfat, paraffin wax, a proprietary material that appeared to be ceresin with approximately 4 per cent. resin, and another consisting of paraffin wax, vaseline and resin (57 : 38 : 5). All gave some protection, though the treated cheeses were all heavily infested after 270 days' exposure to mites. Almost all those found in the cheeses during the experiment were *Tyrolichus casei*.

In the dusting experiments, waxed cheeses were cut in half, the cut surfaces heavily dusted and put face down on a table, and the waxed surfaces coated with dust, or the cut surfaces were placed face down on a layer of dust in a hollow cylinder and the dust applied again, so that a circular barrier about an inch wide was spread on the table round the cheese. The dusts used were dolomite, magnesite, serpentine, sulphur and calcium carbonate, and all had passed through a 150-mesh sieve. Mites and enough food to maintain a strong colony were placed on the table and the cheeses were left in position for 30 or 60 days. The dusts appeared to act in a purely mechanical way, and although they delayed mite invasion, all the treated cheeses eventually became infested. The conditions of low humidity in which dusts would probably be most effective are those least suitable for storing cheese.

Of the fumigants, ammonia gas [*cf.* **22** 479] was highly toxic to the mites in a closed jar, all being killed by exposure to a concentration of 30 mg. per litre for one hour, but gave the outside of the cheese an ammoniacal odour and an

unpleasant soapy taste. The inside was not affected. In large-scale tests, ammonia gas introduced at the rate of 2½ lb. per 1,000 cu. ft. gave a very incomplete kill of mites and the concentration of fumigant fell rapidly; laboratory tests showed that brick, concrete and cheese all absorbed ammonia. Absorption would account for part of the losses observed, the remainder being attributable to diffusion. It was concluded that the production and maintenance of an effective concentration of ammonia in a cheese store was impracticable.

Methyl bromide [*cf.* **33** 343] was less readily absorbed by cheese and killed 76·2 and 79·2 per cent. of the mites in 4 hours at 11 and 12·3 mg. per litre in two laboratory tests. There was little difference in the susceptibility of the two mites, though *Tyrolichus* was slightly the more resistant. Large-scale tests with methyl bromide at 1·2 lb. per 1,000 cu. ft. showed that there was serious stratification of the vapour when no fan was used, and that when the vapour had diffused uniformly through a stack of crates containing a few infested cheeses, its concentration was too low to be effective, so that a considerable proportion of the mites on the cheeses survived. When the methyl bromide, at a concentration of 4·3 lb. per 1,000 cu. ft., was introduced in a shallow pan and a fan drew air over the pan and blew it vertically upwards, a uniform distribution of the vapour was secured. The concentration was very much below that expected, but sufficiently high for the first two or three hours to give effective kill, even under the cheeses and in cracks in them. Isolation and subsequent examination of one of the cheeses, however, showed that eggs under it had not been destroyed. It is concluded that 4 lb. methyl bromide per 1,000 cu. ft. would give useful control of mites in a store-room, but would be too expensive for factory curing rooms, except as an emergency measure in one filled with crated cheese.

Small-scale tests indicated that only a trace of dichlorethyl ether is necessary for control when a thorough distribution of the vapour is obtained and its concentration maintained [*cf.* **33** 130]. Mites from cheese exposed to daily fluctuations of summer temperature were much more susceptible than those from cheese kept at about 45°F. The effect of small differences in concentration was illustrated in one test in which dosages of 0·024, 0·028, 0·032 and 0·036 lb. per 1,000 cu. ft. killed 4, 48·8, 52·5 and 86 per cent. of the mites, respectively. A cheese exposed to dichlorethyl-ether vapour for four weeks had a strong odour of the fumigant on the outside, but none inside, and an unwaxed cheese and a waxed 40 lb. cheese that were sprayed all over with dichlorethyl ether at the rate of 2·5 gm. per sq. ft. surface area and exposed to the air for a week had no taint in the interior. In tests under practical conditions, four heavily infested cheeses and mites in open petri dishes were fumigated in a small room at 48°F. and a relative humidity of 68 per cent. One cheese was wedged up slightly to permit the fumigant to penetrate underneath. The room had a capacity of 1,030 cu. ft., and 0·097 lb. dichlorethyl ether was vaporised from blotting paper wrapped round a metal surface heated to 150°F., over which a current of air was passed by a small fan. After six hours, mortality was considerable in the dishes but negligible on the cheese. When the experiment was repeated at twice the concentration and the room was not aired for 24 hours, all the mites in exposed positions were killed, but those under the cheeses were hardly affected unless the latter were wedged up.

A further test was made in a cool room used for storing vells that had become infested by *Glycyphagus domesticus*, Deg. The vells, which were not obviously infested, were tied in bundles and placed in sacks. The capacity of the room was 14,000 cu. ft., and in the main trial, in which the temperature was 50°F., 8½ lb. dichlorethyl ether was vaporised in 6 hours by a special method. Complete kill of mites in sample tubes in various parts of the room was obtained, but one of the bags of vells was later found to contain living mites, indicating that penetration had not been complete.

Tests on control in cheese-curing rooms were carried out in a room 10 ft. square and 10 ft. high in which the temperature was 45°F. and the relative humidity about 85 per cent., and in which mites had been present for two or three months. The cheeses were removed and a total of 1·2 lb. dichlorethyl ether was applied to the shelves (0·66 lb. per 100 sq. ft.). When it was applied as a 10 per cent. emulsion in water, the volume was such that the liquid tended to run off the shelf, but when it was sprayed on undiluted, the quantity was just enough to wet all the surface of the wood. The room was kept closed overnight and opened next morning for long enough to replace the infested cheeses. The concentration of vapour in the air at that time was high. After three days, the room was aired, and examination of the cheeses showed that all the mites had been killed. A slight odour of dichlorethyl ether persisted for some weeks, and the room remained free from mites for eight months, after which the introduction of mature cheeses from another store resulted in a fresh infestation. A further test was made in a heavily infested commercial curing room with a capacity of 10,080 cu. ft. A total of 14 lb. dichlorethyl ether was applied to the shelves with a brush and to old crates and other materials in the room and to parts of the floor as a light spray, the cheeses being moved to allow application to the shelves and replaced afterwards. Brushing required more liquid than spraying but was more convenient. The concentration of dichlorethyl ether in the air in the middle of the room was 0·7 mg. per litre about 90 minutes after treatment, and examination of the cheeses three days later showed a complete kill of mites. This should be a convenient and effective method of treating a curing room only partly filled with cheese. A sufficiently high concentration of vapour is produced to fumigate the whole room, and traces of dichlorethyl ether remaining in the wood prevent reinfestation on the shelves or under the cheeses for a considerable time. To allow for losses, about 1 lb. dichlorethyl ether per 1,000 cu. ft. of room space should be applied, and the room closed for a day or two.

Dipping the edges of scale boards to a depth of about $\frac{3}{4}$ in. in dichlorethyl ether so that they absorbed 14 oz. and placing the boards under the cheeses did not give control away from the edges, but when the edges were dipped to a depth of 2 ins., so that they absorbed 30 oz. and $1\frac{1}{2}$ oz. was also applied in a hole in the centre of the board, all the mites on the base of the cheeses and many at a slight distance from the outside rim were killed in four days. In a third test, the boards were soaked in water and put through a wringer to squeeze out excess moisture, after which they were submerged in dichlorethyl ether and allowed to drain ; 12 oz. fumigant was absorbed. The boards were put under the cheeses, and living mites were still present at the bases of the cheese after four days but not after a further 14. If scale boards are completely immersed, the amount absorbed is more than enough to give effective control of the mites, so that some method such as the second or third should be used to limit the amount, while giving a fairly uniform distribution of fumigant over most of the surface. The results obtained suggest that the use of treated scale boards would be of value in a store that is well filled with cheeses. If a board is put on top of each cheese as well as underneath, effective fumigation should be secured. It is considered that if dichlorethyl ether is applied to the shelves or scale boards as described, its effect should be sufficiently lasting to make annual treatment sufficient.

JACKS (H.). **Soil Disinfection. V. Comparative Efficacy of Soil Fumigants for Control of Grass-grub** (*Odontria zealandica* **White**).—*N.Z. J. Sci. Tech.* **28** (A) no. 3 pp. 166–170, 2 refs. Wellington, N.Z., 1947.

An account is given in this part of a series on the control of soil organisms in New Zealand of tests of various fumigants against larvae of *Odontria zealandica*,

White, made in 1945–46. In a preliminary experiment, carbon bisulphide at rates of 4 and 8 ml. per cu. ft. soil, and chlorpicrin, Shell D-D (equal parts dichlorpropane and dichlorpropene) and Iscobrome I and II (preparations consisting of 15 per cent. methyl bromide in xylene alone and with the addition of 25 per cent. chlorpicrin, respectively) at rates of 2 and 4 ml. per cu. ft., all gave significant control of the larvae in 48 hours when poured into holes 6 ins. deep in soil in 10-inch flower-pots into which 20 larvae had been introduced on the previous day ; the holes were filled immediately after the application, and half a pint of water was applied to each pot. Iscobrome II was the most effective (100 and 97·5 per cent. mortality at the higher and lower rates, respectively), but all the fumigants except carbon bisulphide killed all the larvae at the higher rate. Chlorpicrin and D-D at the lower rates were the least effective (55 and 50 per cent. mortality, respectively). In another experiment, water emulsions prepared by diluting stock solutions of 1 part Wetsit in 10 parts chlorpicrin or 5 parts D-D or carbon bisulphide were applied at a rate equivalent to about 1 gal. per sq. yard to rye-grass [*Lolium*] sown 30 days earlier in soil in pots to which larvae were added ; water at the same rate was applied after the emulsion had soaked into the soil. Ten days later, chlorpicrin and D-D at rates of 0·37 and 0·75 ml. per cu. ft. and carbon bisulphide at 1·5 and 3 ml. per cu. ft. had all caused significant reductions in the numbers of larvae, and chlorpicrin (which gave 96·25 and 100 per cent. mortality at the two rates, respectively, as compared with 15 per cent. in the controls) and D-D (80 and 97·5 per cent.) were significantly better than carbon bisulphide (62·5 and 80 per cent.). Chlorpicrin damaged the leaves, but did not affect the subsequent growth of the grass.

On 13th June 1945, an infested lawn was treated with chlorpicrin, D-D and carbon bisulphide applied in holes 1 ft. apart or as emulsions watered on the surface after the turf had been loosened lightly with a fork ; in both cases the amounts applied per sq. ft. were 2 ml. for chlorpicrin and D-D and 5 ml. for carbon bisulphide, and the application of the emulsion was followed by one of water at the rate of 1 gal. per sq. yard. Several weeks later, the mean percentages of survival of larvae in plots in which the fumigants had been injected in holes were 21·12, 16·66 and 29·4, respectively, as compared with 87·5 in the controls ; the corresponding percentages for the emulsions were 33·33, 72·91, 70·83 and 94·06. Chlorpicrin was significantly more effective than the other two emulsions, but in the injection experiment, the numbers of larvae present were too small to show comparative efficacy. None of the treatments damaged the grass, and the subsequent growth, especially in the injection plots, was better than that of untreated plots. On 31st May 1946, all the five fumigants were injected into an infested lawn by means of a special injector at points 1 ft. apart. All were used at a rate of 2 ml. per sq. ft. except carbon bisulphide, which was used at 5 ml. On 21st June, the mean percentages of survival of larvae in the plots were 11·14 for chlorpicrin, 16·03 for Iscobrome II, 21·25 for Iscobrome I, 21·36 for carbon bisulphide, 29·74 for D-D and 78·6 for no treatment, a difference of 17·16 being required for significance. Chlorpicrin alone and Iscobrome II caused the grass surrounding the point of injection to wilt, but within a few weeks the growth in the treated plots was markedly better than that in untreated ones.

Kennedy (J. S.), Ainsworth (M.) & Toms (B. A.). **Laboratory Studies on the Spraying of Locusts at Rest and in Flight.**—*Anti-Locust Bull.* no. 2, 64 pp., 11 figs., 14 refs. London, 1948.

Field tests (unpublished) showed that dusts of DNC (3,5-dinitro-ortho-cresol [numbered with CH_3 as 1]) applied from aircraft against settled swarms of *Schistocerca gregaria*, Forsk., were ineffective owing to insufficient and

inconsistent toxicity and the impossibility of treating large areas quickly enough. Laboratory experiments were therefore made in England in an attempt to discover a spray effective in small quantities, and oil solutions of DNC were found to be suitable. The locusts used throughout were laboratory-reared adults of *Locusta migratoria migratorioides*, R. & F., in phases *gregaria* and *transiens*.

The following is largely from the authors' summary. A falling curtain of coarse spray drops of uniform size was produced by running the solution on to a disk spinning at constant speed. The diameter of the drops thrown off was varied between 0·2 and 0·5 mm. by varying the disk speed and, in consequence, the extent to which the drops grew at the disk edge before being torn away by centrifugal force. The locusts were sprayed at rest by fixing them on a stand on a trolley and passing them slowly through the spray curtain for the requisite number of times to acquire the desired dosage, and in motion by suspending them on the arms of a round-about that dragged them through the air at a fixed speed, causing them to beat their wings and passing them through the spray curtain once in every revolution. Dosage was controlled by the number of revolutions and measured by the quantity of spray solution deposited on a horizontal surface exposed with the locusts. The median lethal area dosage was determined with resting locusts that were sexually immature, but older and more resistant than those subsequently employed. It was found to be 1·6 gals. per acre for a solution containing 2·5 per cent. DNC in a mixture of equal parts lubricating and gas oils applied in drops 0·5 mm. in diameter (equivalent to 45 mg. DNC per sq. m.). Comparative tests with 2·5 per cent. solutions of DNC and crude benzene hexachloride (10–12 per cent. γ isomer) showed that the former was about four times as toxic as the latter. The impact of spray droplets on locusts agitated them temporarily and provoked cleaning of the head. Those sprayed with DNC became sluggish in about an hour and either died within 24 hours or survived. Those sprayed with benzene hexachloride became feverishly active, but mortality was not complete for two or more days. No locusts were killed by DDT, even when sprayed with a 5 per cent. solution of the pure p,p′ isomer in oil at a rate of 9 gals. per acre (equivalent to 505 mg. DDT per sq. m.). Various derivatives of DNC were also ineffective, and a solution of DNC in oil was ineffective when sprayed on to pine bark and turf on which the locusts were made to walk.

The quantities of solution collected by the different parts of the locusts' bodies were measured in several ways. Locusts at rest collected an average of seven drops and flying locusts 13·5 drops 0·5 mm. in diameter when exposed to an area dosage of 1 gal. per acre (28 mg. DNC per sq. m.). The median lethal collected dose of a 2·5 per cent. solution of DNC for resistant locusts was calculated as an average total of 0·7 cu. mm. (18 mmg. DNC) for resting locusts and 1·1 cu. mm. (27 mmg. DNC) for flying ones. These doses represent about 10 mg. DNC per kg. for resting and 15 mg. per kg. for flying locusts. By a similar calculation, the median lethal doses of γ benzene hexachloride were about 3 mg. per kg. for resting locusts and 4·5 mg. per kg. for flying ones, not allowing for fumigant effects. The toxic effect produced on the whole insect by applying DNC solution directly to the legs was tentatively estimated as twice that produced by applications to the head and abdomen. Application to the wings appeared to have a negligible toxic effect unless the solution was in very large drops, which were conducted along the veins to the wing articulations. Soft articular areas of cuticle appeared to be especially vulnerable to DNC in oil, as judged by subsequent mortality. Capillary conduction of the solution along cuticular crevices to vulnerable areas was a feature of the insecticidal process that varied in importance with drop size. Irritation symptoms sometimes appeared without subsequent mortality, and mortality sometimes occurred without the prior appearance of such symptoms, depending

on the locus of insecticide application on the body. The insecticide evidently acted in one way to produce the early symptoms and in another way to kill. Flying locusts collected a larger proportion of the total dose of drops 0·5 mm. in diameter on the wings, which are invulnerable, than did those at rest, and therefore required a larger total dose to produce the same mortality. The legs collected more spray than the head and trunk in all conditions, and, since they appeared to be the most susceptible part of the body, the legs were responsible for most of the killing power of the spray. Drops 0·5 mm. in diameter fell vertically on to or past the flying locust, but smaller drops were caught up in the local air currents created by the beating wings. Mainly on this account, the dose collected by the flying locusts and the toxicity of a given spray dosage increased when the drop size was reduced.

In discussing the application of these results to field campaigns, the authors state that the resistance of locusts to DNC has been shown in unpublished work to be directly related to their weight, and that females may be up to twice as heavy as males. Mortality can be increased by increasing the number of drops contained in the dose, and it was found that the dose collected by locusts in flight and its toxic value both increased about ten times when the diameter of the drops was reduced from 0·5 to 0·2 mm. In the field, the surfaces on to which resting locusts may wipe off the spray from their bodies and from which they may pick up spray are often more absorbent than those available to them in the laboratory. When locusts are flying freely, the spray may be prevented from passing along the veins of the hind wings to the vulnerable wing articulations, and it may be thrown off the wings. Locusts normally fly with the legs pressed against the body, but in the laboratory experiments the legs were extended and therefore collected more spray than they would do in the field ; legs in the normal flying attitude provide crevices along which the spray falling on them may pass by capillarity to the soft cuticle of the joints. In dense swarms, the lower locusts may be protected from the spray by those above them. These considerations all indicate that heavier doses may be needed in the field. The possible behaviour of locust swarms subjected to spraying is discussed, and the results of the experiments are compared with those of tests in which flies and mosquitos were sprayed with mist-sprays [*R.A.E.*, B **33** 87 ; **34** 90, 156] in a review of some of the general principles involved in spraying flying insects.

A statistical examination of the results of an experiment on the effect of increasing the dose applied to different parts of the body is given by A. F. Parker-Rhodes in an appendix ; this shows that mortality was significantly increased when the dose applied to the legs, head and abdomen, but not to the wings, was increased from 0·4 to 0·8 cu. mm. In another appendix, A. A. Townsend discusses the theoretical effects of drop size on the collection of spray by flying insects.

Allman (S. L.) & Wright (J. A.). **Grasshopper Control. Recent Developments.** —*Agric. Gaz. N.S.W.* **59** pts. 5–7 pp. 233–236, 283–288, 345–349, 14 figs., 12 refs. Sydney, 1948.

Poison bran baits, especially those poisoned with BHC (crude benzene hexachloride containing 13 per cent. γ isomer), are effective under favourable conditions against grasshoppers in New South Wales, where *Chortoicetes terminifera*, Wlk., is the chief species [*R.A.E.*, A **36** 305, etc.], but their use is not popular with growers because it interferes with other farm operations and requires skilled operators. Large swarms may develop in and migrate from sparsely populated parts of the State where there are large tracts of pasture on which they are difficult to locate and where the loss of some thousands of acres is of little importance if the swarms follow their usual migration to the

south and south-east. In the latter areas, where there are small holdings and arable land is more frequent, the need for control measures is more urgent, and poison baits have been used with success. Recent work has shown that BHC, dinitro-ortho-cresol, chlordane and Toxaphene may all be of value in direct control over large areas [*cf.* **35** 416–418 ; **36** 225–228, 236–237], and tests with these materials applied by various methods were accordingly carried out.

In tests in September 1946 already noticed [**35** 417], BHC and dinitro-o-cresol were applied from an aeroplane at 1 lb. per acre in diesel fuel oil. The results showed that the method was suitable for crop protection, but was too complicated and difficult for widespread adoption. Helicopters, which have been used, apparently with fair success, to disperse dusts of dinitro-o-cresol against locusts in Argentina, might prove more useful.

The Todd Insecticidal Fog Applicator [**35** 259] was used to apply aerosols from the ground. Preliminary tests showed that aerosols with an oil base were less suitable than those with a water base, since they quickly drifted away and only a small proportion touched the ground. Water aerosols were much less perceptible, but appeared to drift closer to the ground and gave fairly effective coverage for a distance of at least 22 yards from the machine. In applying insecticidal aerosols, the truck bearing the equipment was driven at right angles to the direction of the wind, and if the swarm was large, parallel traverses 22 yards apart were made across it. The distributor head outlet was directed downwards so that the aerosol stream first touched the ground several feet from the side of the truck, which generally travelled at three miles an hour. Under these conditions, the rate of application was 2–3 gals. per acre, and an acre could be treated in about three minutes. The aerosol is most concentrated in the part of the swathe nearest to the truck, but as the latter is normally driven along the face of the massed swarm where the hoppers are most numerous, this may not be a disadvantage. BHC was tested in solution at 8 oz. per gal. of a mixture of xylene and dieseline (1 : 3), as a suspension of a 50 per cent. wettable powder, and as a xylene emulsion concentrate, both the latter diluted to give 8 oz. BHC per gal., and chlordane was used in a xylene emulsion concentrate diluted to give 8 oz. chlordane per gal. The BHC solution was of little value, but the effect of the emulsion and suspension became apparent in 15 minutes, though it was sometimes not complete for 24 hours, owing to the arrival of fresh hoppers. When the aerosols are applied in front of an advancing swarm, they may check movement for about 15 minutes and tend to alter its direction ; the residues remained toxic for up to ten days, and dead and dying hoppers were found up to 300 yards from the treated area. Chlordane was slower in action, though eventually as effective as benzene hexachloride, and the residues had a pronounced toxic effect, especially on fresh green vegetation. It was an effective contact poison. The tests were made at various times of day, at temperatures ranging from 70 to 103·5°F. and at relative humidities of 13–100 per cent., as well as during rain. At 70°F. with intermittent rain, the aerosols remained close to the ground for at least 44 yards, and the suspension gave complete control at 103·5°F. and a relative humidity of 13 per cent. when oil-based aerosols rose vertically into the air some 10–15 yards from the machine. The suspension was the cheapest and most consistently effective material tested, but settled out quickly and so required efficient agitation.

In tests with dusts of BHC, chlordane or Toxaphene, chlordane was the most effective, and gave satisfactory results in talc even at a concentration of 2 per cent. It gave good control of the young hoppers within a few hours, but was less effective against those in the fifth instar ; it killed hoppers that fed on the treated area up to a month after application and had little repellent effect. When a 5 per cent. dust was applied from an aeroplane at a rate of 23 lb. per acre to an area of about 3½ acres that was half covered by massed swarms of third-instar hoppers, the latter were almost all destroyed in six hours.

BHC was sometimes of value against young hoppers at a concentration of 10 per cent., but was ineffective against those in the fifth instar even at 20 per cent. It showed considerable repellent effect, and a 10 per cent. dust applied to a bowling green infested by large numbers of flying grasshoppers caused them all to leave it immediately and protected it from further injury for at least 16 days, since any grasshoppers that alighted on it during this period were quickly killed. A dust containing 5 per cent. Toxaphene was used in one test ; it appeared to be ineffective as a contact poison, but exerted a marked repellent action, since hoppers quickly left the area treated with it and no reinfestation occurred for at least five days. A single test was also made with dinitro-o-cresol ; the dust supplied was faulty, but the phytocidal action of this material renders its general use undesirable.

In view of the disadvantages of applying insecticides from the air and the difficulty in many areas of obtaining water in quantity, experiments with sprays were directed to applying relatively small amounts of concentrated insecticide. Knapsack pumps fitted with a special nozzle with an aperture 0·03 in. in diameter that produced a fine mist-like spray at a pressure of approximately 50 lb. per sq. in. were accordingly used ; it was possible to apply 6–10 gals. spray per acre by this means. This apparatus is suitable only for small areas, and aerosols are recommended for large-scale treatment. BHC was highly effective at 5 per cent. in diesel-oil and at lower concentrations in diluted emulsion concentrates or dispersible powders, but the dispersible powders were outstanding. These and the emulsions were effective against young hoppers at a concentration of 1 per cent. BHC, but 2 per cent. was required for the fifth-instar hoppers, and is recommended for general use, with an application rate of 8–10 gals. per acre. The emulsion concentrate of chlordane in xylene gave similar results at the same dosages and concentrations ; a spray applied to turf at the rate of 1 lb. chlordane per acre killed all the hoppers on it and prevented further infestation, although large populations of hoppers developed in the surrounding area.

Chlordane is thus effective in dusts, sprays or aerosols, and BHC in baits, sprays or aerosols, and the choice of treatment must be decided by local considerations. The final cost of dusting is high, and the use of sprays is limited by the difficulty of water supply. Equipment for applying aerosols is expensive, but the cost of the treatment is not excessive, even when compared with that of poison bait.

Insect Pests.—*Agric. Gaz. N.S.W.* **59** pt. 5 pp. 257–262, 8 figs. Sydney, 1948. *T.c.* pt. 6 pp. 305–308, 313, 5 figs. *T.c.* pt. 7 pp. 369–374, 390, 12 figs.

The first of these three parts of a series on insect pests in New South Wales [*cf. R.A.E.*, A **36** 344] contains notes on the bionomics and control of the principal pests of beans. Most of the information has been noticed from an earlier part [*cf.* **31** 263], but recommendations are now included for the use of a spray consisting of 3 fl. oz. of a 20 per cent. DDT emulsion concentrate in 4 gals. water against *Agromyza phaseoli*, Coq., *Nezara viridula*, L., Aphids, thrips, *Empoasca* sp., *Megacoelum modestum*, Dist., and the larvae of *Plusia* spp., *Heliothis armigera*, Hb., *Zizera* (*Zizeeria*) *labradus*, Godt., and *Maruca testulalis*, Geyer ; a 2 per cent. DDT dust is also effective against the Lepidopterous larvae.

The insects dealt with in the second part are *Quadraspidiotus perniciosus*, Comst., which occurs in varying abundance on pome and stone fruits in most orchards, *Aulacaspis rosae*, Bch., which infests the stems and older branches of rose, blackberry, loganberry and raspberry, and *Listroderes obliquus*, Gylh., which attacks almost all kinds of winter vegetables. *Q. perniciosus* can be controlled by dormant sprays of miscible red oil (1 : 24) or a combination of

1 gal. each of semi-dormant or pale oil and lime-sulphur in 18 gals. water, which also controls prune scale [*Eulecanium pruinosum*, Coq.] [*cf.* **28** 288]. Since it has been observed that tar distillate sprays, which are commonly applied in winter to stone-fruits for the control of Aphids, tend to favour the development of *Q. perniciosus*, it is recommended that nicotine sulphate (1 pint to 75 gals.) should be included against Aphids in the dormant sprays applied against the Coccid. Dormant sprays of dinitro-ortho-cresol in oil also control both pests. A spray of white oil emulsion (4 fl. oz. to 1 gal.) should be applied during the period of greatest dormancy of the plants against *A. rosae* and repeated if necessary about six weeks later. *Listroderes* can be controlled on root crops by the DDT treatments recommended in the first part, poison baits or dusts and sprays of lead arsenate [**31** 137].

In the third part, information is brought together on various insects of which the larvae bore in orchard or shade trees and other plants. They comprise a number of Coleoptera [*cf.* **26** 335, 404 ; **27** 602 ; **28** 513 ; **29** 335, 609 ; **30** 232], including *Diadoxus scalaris*, C. & G., which attacks *Callitris* and *Cupressus* spp. but is less common than *D. erythrurus*, White [*cf.* **30** 232], and the Tineid, *Cryptophasa* (*Maroga*) *unipunctata*, Don., the larvae of which make tunnels 3–4 ins. long in stone-fruit or shade trees. They shelter in these during the day and leave them at night to feed on the bark round the entrances. On small trees with upright trunks, this feeding may lead to ring-barking.

Morison (D. L.). **The Wax Moth and its Control.**—*Agric. Gaz. N.S.W.* **59** pt. 7 pp. 375–379, 4 figs., 1 ref. Sydney, 1948.

The bionomics of the greater wax moth, *Galleria mellonella*, L., which is reported to have been introduced into Australia about 1872, are summarised from an account already noticed [*R.A.E.*, A **24** 563], and recommendations are made for its control and that of the lesser wax moth, *Achroia grisella*, F., in New South Wales, where legislation passed in 1944 requires bee-keepers to disinfect any infested material in their possession. To minimise infestation in the hived colony, the hive material should be free from joints and cracks in which the moth larvae may shelter, and the bottom board should be kept clean. Directions are given for the fumigation of stored combs with hydrocyanic acid gas (generated from Cyanogas calcium cyanide), carbon bisulphide and para-dichlorbenzene, and also with sulphur dioxide produced by burning sulphur, which, however, has fallen into disuse owing to its highly irritant effect.

Shanahan (G. J.) & Shelton (A. B.). **Cheese Mite Control. Use of Dichlorethyl Ether as a Fumigant.**—*Agric. Gaz. N.S.W.* **59** pt. 7 pp. 381–383, 1 fig., 4 refs. Sydney, 1948.

The commonest of the Tyroglyphid mites that infest cheese in New South Wales are *Tyroglyphus farinae*, Deg., and a species of *Tyrophagus* referred to as *T. putrescentiae*, Schr. [*cf. R.A.E.*, A **31** 69, 157], while *Glycyphagus domesticus*, Deg., is not uncommon. In view of the promising control of cheese mites given by dichlorethyl ether in recent tests [**36** 363 ; **37** 16], an experiment with it was carried out in October 1947 in a storage room in Sydney containing various cheeses, mostly cheddar, lightly to heavily infested with mites. The cheeses were not wedged apart. Prior to treatment, the circulatory system of the room was turned off, and the temperature, which was normally maintained at 42–45°F. with a relative humidity of about 80 per cent., was allowed to rise to 52°F. Dichlorethyl ether, at the rate of 1 lb. per 1,000 cu. ft., was sprayed into the room as a fine mist, care being taken to avoid spraying directly on to the cheeses, and the room was aired 64 hours later. The treatment proved extremely effective against mites that were fully exposed to the fumigant, but

there was a high rate of survival among those that were not. The population gradually increased after the treatment, and refumigation would have been advisable after 2½ months. Although the odour of dichlorethyl ether was distinctly noticeable in the treated room several weeks after treatment and a slight odour could be detected in the rind of the cheese for some days, there was no taint in the body of the cheese and its quality was not impaired.

WILSON (H. B.). **Wood Borers in Buildings in Victoria.**—*J. Dep. Agric. Vict.* **46** pt. 4 pp. 183–189, 5 figs. Melbourne, 1948.

The only wood-boring insects commonly found in buildings in Victoria are *Lyctus brunneus*, Steph., which attacks the sapwood of hardwoods but does not infest softwoods, and *Anobium punctatum*, Deg., which is found in softwoods such as Baltic pine [spruce] and on some local and imported hardwoods but does not attack the *Eucalyptus* timbers that are mostly used for the framework of buildings in Victoria. The life-histories of both beetles are reviewed and the signs of infestation described [*cf. R.A.E.*, A **13** 228]. The hardwoods attacked by *Lyctus* include *E. obliqua*, which is used for building construction, but only the sapwood is infested, and about half of this is immune because it does not contain enough starch for the larvae [*cf.* **24** 372]. Since it has been estimated that less than 15 per cent. of the pieces of hardwood timber used for building scantling contain any sapwood, more than 90 per cent. of such timber is probably immune from *Lyctus* attack. In practice, *Lyctus* damage to building frameworks in Victoria is very slight, and protective treatments are unnecessary. It occasionally attacks flooring or lining timbers, but the damage is not important. Since *Anobium* does not confine its attacks to sapwood, it can cause extensive damage to softwood flooring and lining timbers in buildings, and control measures should be carried out as soon as infestation is discovered. Badly damaged timber should be replaced, or, where this is undesirable or where damage is slight, a solution of paradichlorbenzene in kerosene (1 : 10) should be injected into the flight holes.

Living termites are sometimes found in building scantling fresh from the sawmill. The species concerned are forest insects that die out as the timber dries, and should not be confused with soil-dwelling termites, which can cause serious damage to seasoned timber.

The sapwood of *Eucalyptus* is sometimes attacked while green by the small Bostrychid, *Xylion collaris*, Erichson, which causes damage similar to that due to *Lyctus*. It cannot effect serious injury to seasoned timber, and no treatment is necessary, but the adults have been known to make short holes in seasoned timber during the summer months.

STEPHENS (R. M.). **Codling Moth Control. DDT Trials in the Goulburn Valley.**—*J. Dep. Agric. Vict.* **46** pt. 5 pp. 212–214, 1 graph. Melbourne, 1948.

Further tests of DDT against the codling moth [*Cydia pomonella*, L.] on pear in the Goulburn Valley, Victoria [*cf. R.A.E.*, A **36** 179] were carried out in 1947–48 with special reference to the timing and concentrations of the sprays. The trees at Kyabram and Shepparton East received two or three applications of sprays containing 0·1 or 0·05 per cent. DDT prepared from a proprietary paste containing 36 per cent. w/w p,p′ DDT and white oil. The first two applications of each treatment were made on 21st October and 5th November ; owing to wet weather, it was not possible to employ four-spray schedules as had been intended, and the three-spray schedules were consequently duplicated. The percentages of fruits damaged at Kyabram and (in brackets) at Shepparton East were 4·04 (1·46) for two applications of 0·1

per cent. DDT, 8·45 (3·25) for two of 0·05 per cent. DDT, 2·52 and 1·93 (0·35 and 0·10) for three applications of 0·1 per cent. DDT and 5·81 and 5·71 (1·95 and 0·26) for three of 0·05 per cent. DDT. Statistical analysis showed that the differences due to concentration and to number of applications were highly significant. The significantly higher level of infestation at Kyabram may have been due to the high infestation of the surrounding trees, which had been sprayed with lead arsenate. Chloritic mottling was very evident, particularly at Shepparton East, adding support to the contention that even small quantities of oil should not be included in a DDT programme.

The work at Ardmona was directed to determining the relation between the emergence of adults of *C. pomonella* and the timing of the first spray. The trees received three applications of sprays prepared from a dispersible powder containing 50 per cent. w/w p,p′ DDT, diluted to contain 0·1 per cent. DDT. Five different schedules were employed, in which the first applications were made on dates ranging from 21st October (petal-fall) to 19th November ; the second applications were made early in December and the third early in January in each case. The percentages of fruits damaged were 2·43, 2·22, 1·82, 3·16 and 5·8 for schedules beginning on 21st October, 29th October and 5th, 12th and 19th November, respectively. Statistical analysis showed that the effect of the time of spraying on infestation could be represented by a quadratic curve, the trend of which was highly significant. From a comparison of these results with the weekly averages of moths caught, it is concluded that the optimum time for the first spray corresponds with the first major peak of adult emergence, although in 1947–48, when this date fell in the week ending on 5th November, it could have been applied with safety at any time from petal-fall until 10th November.

It is concluded from the tests that *C. pomonella* can be effectively controlled on pear with a schedule of three sprays of 0·1 per cent. DDT, the first applied preferably in the eight days following the first major peak of moth emergence. No serious infestation by mites has developed in the Valley following the use of DDT ; *Bryobia praetiosa*, Koch, has been adequately controlled by a dormant oil spray ; and, if necessary, both *Bryobia* and *Tetranychus telarius*, L. (*urticae*, Koch) could be controlled in summer by spraying with hexaethyl tetraphosphate [*cf.* **36** 246]. Where the use of lead arsenate has been discontinued and no DDT has been applied in mid-season, an increase of *Tortrix postvittana*, Wlk., has been noticed, but one spray of lead arsenate at the usual strength in midsummer should give adequate control.

Smith (W. A.). **Control of the Banana Aphid.**—*Qd agric. J.* **66** pt. 6 pp. 351–352. Brisbane, 1948.

A small experiment was carried out in Queensland to compare the effectiveness of synthetic organic insecticides with that of nicotine against *Pentalonia nigronervosa*, Coq., which occurs in banana plantations throughout the State and transmits the virus that causes the bunchy-top disease [*cf. R.A.E.*, A **29** 149, etc.]. Dusts containing 4 per cent. BHC (benzene hexachloride), a mixture of 1 per cent. each of BHC and DDT, or 3 per cent. nicotine or a spray containing 0·1 per cent. hexaethyl tetraphosphate with a spreader were applied liberally to the pseudostems, funnel leaves, suckers and bunches, and the Aphid populations were estimated just before and two days after treatment. A kill of 50 per cent. or perhaps more was obtained on the pseudostems, but the percentage was much higher on suckers and funnel leaves, where the colonies were more exposed. The dusts containing BHC alone or with DDT gave slightly better control of the Aphids on the pseudostems than did the nicotine dust or the hexaethyl-tetraphosphate spray, and the toxic residues of the DDT and BHC might be of additional importance in controlling both the Aphids and the

ants that carry them about ; observations two days after treatment, however, showed no noticeable difference in ant behaviour.

The high survival rate of the Aphids was due to the failure of the insecticides to penetrate under the leaf-stalks and into the tightly rolled funnel leaves, and plantation practices that make the stem more accessible to dusting, including those in which only one sucker is retained and the stems are frequently trashed, would probably result in better control. In the experiment, the thorough application of dusts at about 20 lb. per acre in a plantation in which the one-sucker system was employed required about 2½ hours per acre, though the period would probably have been less if the stems had been clean and easily accessible. In summer, when Aphid reproduction is rapid, treatment would probably be required every 2–3 weeks, and the use of a dust containing BHC, alone or with DDT, at such frequent intervals is unlikely to prove an economic method of controlling bunchy-top disease. The author therefore concludes that there is as yet no justification for modifying the present recommendations for the control of *P. nigronervosa* [*cf.* **18** 31].

PRUTHI (H. S.). **Report of the Imperial Entomologist.**—*Abridg. sci. Rep. agric. Res. Inst. New Delhi 1941–44* pp. 64–71. Delhi, 1946.

ISAAC (P. V.). **Report of the Imperial Entomologist.**—*Sci. Rep. agric. Res. Inst. New Delhi 1944-45* pp. 73–79. 1946.

The first of these reports contains a summary of work on injurious and beneficial insects in India in the three years from July 1941 to June 1944 and the second a similar account for 1944–45. It is stated in the first that large-scale field trials of sprays against *Bemisia tabaci*, Gennadius, the vector of tobacco leaf-curl, during two seasons confirmed earlier findings that fish-oil resin soap applied four times at weekly intervals beginning when the plants were about 6–8 weeks old gave satisfactory control and reduced the incidence of the disease. In 1944–45, the infestation in plots sprayed six times with the soap at 1 oz. per gal. increased from 5·4 to only 33·3 per cent., while that in control plots increased from 6·9 to 78·8 per cent.

Studies begun in April 1942 showed that about a dozen insects are injurious to stored sorghum, the most important being *Calandra* (*Sitophilus*) *oryzae*, L., *Rhizopertha dominica*, F., *Sitotroga cerealella*, Ol., *Corcyra cephalonica*, Staint., *Tribolium castaneum*, Hbst., and *Oryzaephilus* (*Silvanus*) *surinamensis*, L. They soon die if the moisture content of the grain is less than 7 per cent., but breed freely if it is 12 per cent. or more. Exposure to 55°C. [131°F.] for 15 minutes destroyed them without damaging the grain. Of a large number of inert dusts tested as preventives, calcium carbonate (1 : 200) was the best. In 1944–45, DDT and benzene hexachloride diluted with chalk and mixed with the grain at 1 : 5,000 and 1 : 10,000, respectively, gave complete mortality of five pests in three days, but larvae of khapra [*Trogoderma granarium*, Everts] were still alive after 17 days. The major pests of dried fruit in India are stated in the first report to be *Tribolium castaneum*, *R. dominica*, *Laemophloeus* sp., *S. cerealella* and *C. cephalonica*. All were killed when the fruit was exposed to 48°C. [118·4°F.] for 35 minutes or 46°C. [114·8°F.] for 85 minutes.

Observations on *Bagrada cruciferarum*, Kirk. (*picta*, F.) recorded in the earlier reports showed that the eggs are laid in the soil [*cf. R.A.E.*, A **32** 408] and not on the plants, as previously thought. Spraying with a kerosene emulsion gave good control. There was an outbreak of this Pentatomid on cruciferous crops at New Delhi from March to May 1945, and neighbouring sugar-cane seedlings were also attacked.

The survey for *Icerya purchasi*, Mask., in Peninsular India that was begun in 1943 [**34** 287] was continued in 1944–45, when the Coccid was found in five additional districts in the Madras Presidency, into all of which it had been

introduced on seedlings of *Casuarina equisetifolia*. It caused serious damage to *Citrus* at only one place in the Presidency, though it was present on it in small numbers at others in the neighbourhood and at Bangalore. Seven new food-plants are recorded. A simultaneous survey for *Quadraspidiotus perniciosus*, Comst., was made over the whole period, and it was found on apple in the Nilgiri and Shevaroy Hills [*cf.* **33** 391].

Eurygaster maura, L., is recorded in the first report for the first time from India; it occurred in the Zhob Valley, Baluchistan, where it caused considerable damage to wheat and destroyed over 90 per cent. of the crop at one place.

Work on the biological control of sugar-cane pests was extended in 1942, and the most suitable temperatures and relative humidities for rearing *Trichogramma* [*minutum*, Ril.] and its laboratory host, *Corcyra* [*cephalonica*] were found at New Delhi to be 74–78°F. and 50–60 per cent., respectively; 150 million individuals of *Trichogramma* were reared in 1942–44 and released against sugar-cane moth borers at eight widely separated places. Its mass rearing was continued during 1944–45 and over 30 million individuals were obtained. The females parasitised a maximum of 30 eggs at 25°C. and 90 per cent. relative humidity, and the adults survived for up to a week when fed on 10 per cent. sugar solution, but for only 2·5 days without food. Liberations against moth borers were made at three places, in Bengal, Bihar and Bhopal. In Bengal, there was no initial egg parasitism of either root-borer [*Emmalocera depressella*, Swinh.] or stem-borers, but the percentage parasitism of the former in plots in which releases were made was 21·85 in August and 28·68 in October, as compared with 5·5 and 0 in the controls, and that of the latter 21·63 and 36·58, as compared with 1·5 and 27·7. The average yield from the colonised plots was almost a third greater than that from the controls. In Bihar, parasitism of eggs of stem borers during August was 57·3 per cent. in colonised plots and 16·5 per cent. in the controls, and the yield from the former was increased by almost a quarter except in some plots in which it was reduced by floods. In Bhopal, the percentages of eggs of *Proceras* (*Argyria*) *sticticraspis*, Hmps., parasitised in the colonised and (in brackets) control plots were 9·68 (19·76) in July, 10·75 (3·87) in September, 5 (0) in December, and 0 (0) at harvest. It is stated in the first report that the yield of sugar-cane was increased by removing the eggs of *Pyrilla*, whether or not the parasites in them were allowed to escape [*cf.* **32** 411], but the value of preserving the parasites was confirmed at Karnal in 1944–45, when the percentage parasitism varied from 7·4 in November to 23·42 in February.

Studies were begun at Karnal in 1941 in which sugar-cane setts were immersed in various liquids to protect them from damage by termites. Those that gave promising results were, in order of efficiency, a solution of mercuric chloride (corrosive sublimate), diluted coal tar, and a suspension of Paris green in coconut oil. Near Delhi, termite workers about 3 ins. below the surface of the soil were attacked by the larvae of *Dasus* (*Gonocephalum*) *depressus*, F., and *Rytinota impolita*, Fairm. A survey at New Delhi in 1944–45 showed that *Odontotermes* (*Cyclotermes*) *obesus*, Ramb., was the commonest termite there; the workers were found under cowdung and dry grass, but did not attack living plants. Other species included *Microtermes anandi*, Hlmgr., which occurs in cowdung and attacks wooden structures in contact with the soil and freshly planted sugar-cane setts, and *M. obesi*, Hlmgr., which occurs in houses.

During work on pests of potato in 1941–44, *Empoasca kerri* var. *motti*, Pruthi, was found to occur commonly throughout the season; both nymphs and adults usually feed on the lower surface of the leaves. *Megacoelum stramineum*, Wlk., was common from October to December, and the life-cycle of both species was completed in one month in winter. Oviparous females of *Myzus persicae*, Sulz., have not been recorded from India. Observations in 1944–45 showed that this Aphid breeds on potato from September to December.

The development of apterous and alate forms lasted 9–11 and 13–14 days, respectively; apterous and alate adults survived for 18 and 21 days and produced 22–24 and 20–21 progeny, respectively. The predacious Syrphids, *Sphaerophoria javana*, Wied., and *S. indiana*, Big., were found to consume, respectively, 238 and 200 adults and nymphs of *M. persicae* during their development. In work directed to the control of pests of stored potatoes, summarised in the first report, it was found that *Gnorimoschema operculella*, Zell., oviposits on the tubers most freely at 81°F. and 100 per cent. relative humidity and produces as many as 12 generations a year. If the potatoes are kept under dry conditions, the moths do not oviposit and the larvae do not penetrate more than an inch below the surface of the heap. Carbon bisulphide used at a rate of 1 oz. per 2 cu. ft. space was the most effective fumigant tested. It is stated in the second report that mass breeding of *Bracon* (*Microbracon*) *gelechiae*, Ashm., a parasite of *G. operculella* that was imported from Canada, was in progress, 300–400 parasites being produced daily.

In laboratory experiments with insecticides during 1941–44, an aqueous extract of seeds of *Thevetia neriifolia* at a dilution of 1 : 20 gave about 80 per cent. mortality of larvae of *Laphygma exigua*, Hb., and *Plusia orichalcea*, F., in the first three instars that fed on leaves dipped in it, but was ineffective against older larvae and against *Aphis laburni*, Kalt., and *Macrosiphum solidaginis*, F. Zinc arsenate (11 lb. in 100 gals. water with the addition of lime) killed larvae of *Aganais ficus*, F., *Cosmophila* (*Anomis*) *flava*, F., and *Ocinara varians*, Wlk. In tests in 1944–45, opium and opium marc (a waste product left after the extraction of opium) were not toxic as stomach poisons to larvae of *Euproctis lunata*, Wlk., or *Bombyx mori*, L., and opium marc in water was not very effective as a contact insecticide, giving 64·5 and 0 per cent. mortality of *B. mori* at concentrations of 20 and 2 per cent. A dilute acetic-acid extract of opium marc was promising, a 5 per cent. solution giving 85 per cent. mortality of larvae of *B. mori* and 91·9 per cent. mortality of adults of *Bagrada cruciferarum*. A 0·2 per cent. suspension of crude opium gave 92 and 83·5 per cent. mortality of these insects, respectively.

The more important species found during a survey of the sucking insects on various crops in 1944–45 included *Empoasca devastans*, Dist., on cotton, *Creontiades pallidifer*, Wlk., on brinjal [*Solanum melongena*], safflower [*Carthamus tinctorius*], peas and lucerne, *Campylomma livida*, Reut., on sorghum and maize, *Lygaeus pandurus*, Scop., on grape vine and *Citrus*, *Myzus persicae* on tobacco and tomato, *Aphis gossypii*, Glov., on cotton and tomato, *A. laburni* on cowpea and chillies [*Capsicum*], *Urentius echinus*, Dist., on *S. melongena*, *Nysius inconspicuus*, Dist., on tobacco capsules, *Diaphorina citri*, Kuway., on *Citrus*, and *Rhopalosiphum pseudobrassicae*, Davis, on cruciferous crops.

Other insects recorded as of importance near Delhi in the first report include *Amsacta moorei*, Btlr., on cowpeas, maize and sorghum, *Antigastra catalaunalis*, Dup., on *Sesamum*, *Chilo zonellus*, Swinh., on sorghum and maize, *Cosmophila flava* on cotton and bhindi [*Hibiscus esculentus*], *Euproctis lunata* on castor [*Ricinus communis*], *Heliothis armigera*, Hb., on lucerne, *Hellula undalis*, F., on cabbage and cauliflower, and *Aulacophora foveicollis*, Lucas, *Dacus ciliatus*, Lw., and *D. cucurbitae*, Coq., on curcurbits. Those that occurred at New Delhi in 1944–45 included *Scirpophaga nivella*, F., on sugar-cane, *Chilo zonellus* on maize, sorghum and bajri [*Pennisetum typhoides*], *Utetheisa pulchella*, L., and *Cydia* (*Laspeyresia*) *pseudonectis*, Meyr., on sunn-hemp [*Crotalaria juncea*], *Taeniothrips distalis*, Karny, *Adisura atkinsoni*, Moore, and *Agromyza obtusa*, Mall., on arhar [*Cajanus cajan*], *Laphygma exigua* on peas, *Earias insulana*, Boisd., *E. fabia*, Stoll, *Platyedra gossypiella*, Saund., and *Dysdercus cingulatus*, F., on cotton, *Eublemma olivacea*, Wlk., *Selepa docilis*, Btlr., *Phycita clientella*, Zell., and *Leucinodes orbonalis*, Gn., on *Solanum melongena*, *Agrotis* sp. on

tomato, *Dacus* sp., *Aulacophora foveicollis*, *Mylabris pustulata*, Thnb., *Epilachna vigintioctopunctata*, F., *E. dodecastigma*, Muls., and *Sphenarches caffer*, Zell., on cucurbits, *Euproctis lunata*, *Achaea janata*, L., and *Dichocrocis punctiferalis*, Gn., on castor, *Antigastra catalaunalis* on *Sesamum*, and *Amsacta moorei* on *Carthamus tinctorius*.

The first report also includes notes on the successive invasions of India by locusts [*Schistocerca gregaria*, Forsk.] from the north-west in 1941–44, the subsequent migrations, the organisation of control and the success achieved [*cf.* next abstract].

Pruthi (H. S.). **Report of the Locust Warning Organisation.**—*Abridg. sci. Rep. agric. Res. Inst. New Delhi 1941–44* pp. 72–76. Delhi, 1946.

The Government of India established a permanent Locust Warning Organisation in March 1939, with headquarters at New Delhi and a substation at Karachi, and in 1942, as a result of a conference of the States and Provinces likely to be invaded by locusts [*Schistocerca gregaria*, Forsk.] a control organisation for all India was set up. Anti-locust work was carried out by delegations from India in south-western Persia in 1942, in Oman, the Trucial west and southern Persia in 1942–43 and in the Persian Mekran and Oman in 1944. The course of the locust invasions of India from June 1941 to June 1944 and the control work carried out is briefly reviewed [*cf.* also next abstract].

Pruthi (H. S.). **Report of the Director, Locust Control in India.**—*Sci. Rep. agric. Res. Inst. New Delhi 1944–45* pp. 80–82. Delhi, 1946.

As a result of the control measures adopted by the Indian anti-locust organisation in India and in the monsoon breeding areas in the Persian Mekran and Oman [*cf.* preceding abstract], India was free from swarms of locusts [*Schistocerca gregaria*, Forsk.] from November 1943 until March 1944, when a fresh invasion began from the north-west [*cf. R.A.E.*, A **29** 519–520]. Breeding had not occurred in Persia or Oman, but had taken place actively in the Sudan, East Africa and the Red Sea Coast. Swarms continued to arrive during April. Eggs were laid in Baluchistan, where most of the resulting hoppers were controlled by June, and also in Sind, where some adults matured in spite of control measures. Further immigration from the west into Sind and Rajputana occurred in June, and one small swarm reached the Central India States and another Cutch State in the middle of July; the United Provinces were not invaded. Swarms developed all over the desert tracks of Sind-Rajputana and the southern Punjab, and young cotton was slightly damaged in some parts of Sind and the Punjab. Eggs were laid in July in almost all the States and monsoon breeding occurred in Baluchistan for the first time during the present cycle, but practically all the resulting swarms were controlled. Two or three developed, however, and migrated to the Punjab and Sind, where, in October–November, they produced a very small second generation, which was destroyed. Fresh swarms developed in Arabia and on the Red Sea coasts early in 1945, and Baluchistan was invaded in late March and April by swarms moving across Persia and Afghanistan. Extensive oviposition took place in northern Baluchistan, but almost all the hoppers that hatched there were destroyed. Many of the swarms, however, migrated on into the Punjab and the North-West Frontier Province, where eggs and hoppers were reported from several localities in May, and one entered the United Provinces. Immature locusts continued to invade British Baluchistan during May.

Venkatraman (T. V.). **A new Pest of Sugarcane in India**—*Icerya pilosa nardi* **Green (Coccidae).**—*J. Bombay nat. Hist. Soc.* **46** no. 3 pp. 524–528, 2 pls., 6 refs. Bombay, 1947.

The first record in India of *Icerya pilosa* var. *nardi*, Green, referred to by Isaac as *I. pilosa*, Green [*R.A.E.*, A **26** 243], was due to its finding by the author on sugar-cane seedlings at Coimbatore. It was present in all stages, chiefly on the lower surface of the leaves ; infested leaves turned yellow and very young seedlings were killed. It has since been recorded by Pruthi & Rao [**32** 408] and has been found on sugar-cane in Delhi, Meerut and Karnal, *Saccharum ravennae* in Delhi and *S. spontaneum* at Coimbatore.

All stages, except the egg, of both sexes are described. Males, which had an adult life of 2–4 days, were less numerous than females, and parthenogenesis appeared to be usual, though mating was observed in a few cases. The average durations of development in days were 9 for the eggs and 19 and 21 for the first and second instars of both sexes, 16, 8 and 7 for the third and fourth instars and the pupal stage of the male, all of which are passed within a cocoon, and 18, 12 and 23 for the third instar and preoviposition and oviposition periods of the females. A large female laid 49 eggs and a smaller one, 32. Larvae of *Rodolia* (*Novius*) *guerini*, Crotch, attacked all stages, but were heavily parasitised by an Encyrtid, *Homalotylus flaminius*, Dalm. Two species of ants visited the Coccids and sometimes attacked the Coccinellid larvae.

Freeman (P.). **A Revision of the Genus** *Dysdercus* **Boisduval (Hemiptera, Pyrrhocoridae), excluding the American Species.**—*Trans. R. ent. Soc. Lond.* **98** pt. 8 pp. 373–424, 59 figs., 4 pp. refs. London, 1947.

This revision of the species of *Dysdercus* of the Ethiopian, Oriental and Australasian regions includes descriptions of the genus (with an account of the morphology of the male genitalia) and of the specific groups and species, with keys to the species and records of their distribution ; 28 species are recognised, of which one is new. It is considered that the author of the genus was Boisduval (1835), and *D. decussatus*, Boisd., is designated as the genotype. New synonymy affecting species that have been mentioned in this *Review* includes *D. decussatus* (*crucifer*, Stål, *simplex*, Wlk., *cruciatus*, Montr.), *D. oceanicus*, Boisd. (*impictiventris*, Stål), *D. haemorrhoidalis*, Sign. (*ugandanus*, Schout.), *D. nigrofasciatus*, Stål (*superstitiosus* var. *tergiversans*, Hussey) and *D. sidae*, Montr. (*insularis*, Stål).

Broadbent (L.). **An Analysis of Captures of Aphididae (Hemiptera) in a Light Trap.**—*Trans. R. ent. Soc. Lond.* **98** pt. 11 pp. 475–490, 1 fig., 14 refs. London, 1947.

The following is almost entirely the author's summary. Records of the numbers of Aphids caught in a light-trap operated nightly in a field at Rothamsted during 1933–36 are analysed, on arithmetic and logarithmic bases, month by month and for successive periods throughout the night. Aphids were taken during the night in each month from May to November. An attempt was made to correlate the numbers caught between 3rd June and 30th September 1933 with meteorological factors. Activity was found to be correlated positively with the maximum temperature of the previous day and with the evening reading of the dew point and negatively with the wind force of the previous afternoon ; wind direction also had a significant effect. Population changes from year to year were probably dependent to a great extent on the summer rainfall, the population being lower in wet years.

Kanervo (V.). **Hajahavaintoja eräiden hyönteislajien taudeista. 3. Kaalikoin (*Plutella maculipennis* Curt.) taudeista.** [Sporadic Observations concerning Diseases in certain Species of Insects. 3. Diseases attacking *P. maculipennis*.]—*Ann. ent. fenn.* **12** no. 4 pp. 143–153, 2 figs., 6 graphs, 11 refs. Helsinki, 1947. (With a Summary in English.)

This third part of a series on diseases of insects in Finland [*cf.* *R.A.E.*, A **34** 271] contains information on the fungi that were found infesting various stages of *Plutella maculipennis*, Curt., collected mostly near Helsinki in the years 1928–30 and 1936–46.

The larvae were attacked by *Entomophthora sphaerosperma* in almost every year, by another species thought to be *E. virescens* in two years, and by a third, probably *E. blunckii*, in one district in a single year. The pupae were much less affected by disease ; the fungi found in dead pupae were mostly *E. sphaerosperma*, but in three instances spores of *Fusarium* sp. were observed. Spores of *Fusarium* and *Penicillium* were occasionally found in adults, but it is not known whether these were the cause of death. The percentages of larvae that died of disease within a week after collection were high (50–60) only at times when the larvae were very numerous and the relative humidity had been high for a considerable time. Mortality of third- and fourth- instar larvae was much greater than that of younger larvae ; the percentage mortality of pupae reared from the material collected varied from 0 to 20.

Brincourt (R.). **Contribution à l'étude de la lutte contre la cératite par le D.D.T.**—*Fruits Primeurs Afr. N.* **17** no. 178 p. 103. Casablanca, 1947.

An account is given of an experiment carried out in an orchard near Casablanca in which commercial preparations of DDT were applied against *Ceratitis capitata*, Wied., on peach. The experimental trees, which were situated next to an orange grove, were of late varieties and had previously given poor yields owing to infestation by the fruit-fly. On 23rd June, 28 adults of *C. capitata* were found in trap-glasses that had been placed four days previously in peach trees of early varieties and in apricot trees, and on 30th June 152 were taken. As the population appeared to be increasing rapidly, the trees were dusted with DDT on 1st July. Further considerable catches (510, 190 and 641) were recorded on 6th, 13th and 20th July, and the trees were sprayed with DDT and a wetter after each of them. The catches fell off very considerably from the end of July. It was notable that a yield of fruits was obtained from these hitherto unproductive trees ; after harvest, the trap-glasses were transferred to the adjacent orange trees, but few flies were caught. The author considers that the decrease in injury was due to the effects of the treatments, and that, although the dust was easier to apply, sprays, which are much cheaper, were as effective.

Papers noticed by Title only.

Creel (C. W.) & Rockwood (L. P.). **The Control of the Clover-flower Midge [*Dasyneura leguminicola*, Lint., in the United States].**—*Fmrs' Bull. U.S. Dep. Agric.* no. 971 (revd.), 9 pp., 6 figs. Washington, D.C., 1947. [*Cf.* *R.A.E.*, A **7** 4 ; **20** 656.]

Uvarov (B. P.). **Recent Advances in Acridology : Anatomy and Physiology of Acrididae.** [A review of the literature since 1928.]—*Trans. R. ent. Soc. Lond.* **99** pt. 1 pp. 1–75, 21 figs., 12½ pp. refs. London, 1948 ; also as *Anti-Locust Bull.* no. 1, 75 pp., 21 figs., 12½ pp. refs. London, 1948.

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Subjects	*Openers*
Recent Developments in Insecticides	R. A. E. Galley
Mode of Action of new Insecticides	V. B. Wigglesworth
Uses and Limitations of the new Insecticides in the Field	W. A. Ross
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Application of Insecticides from the Air ...	D. L. Gunn
Biological Control	A. B. Baird W. Cottier R. H. Le Pelley D. Miller
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